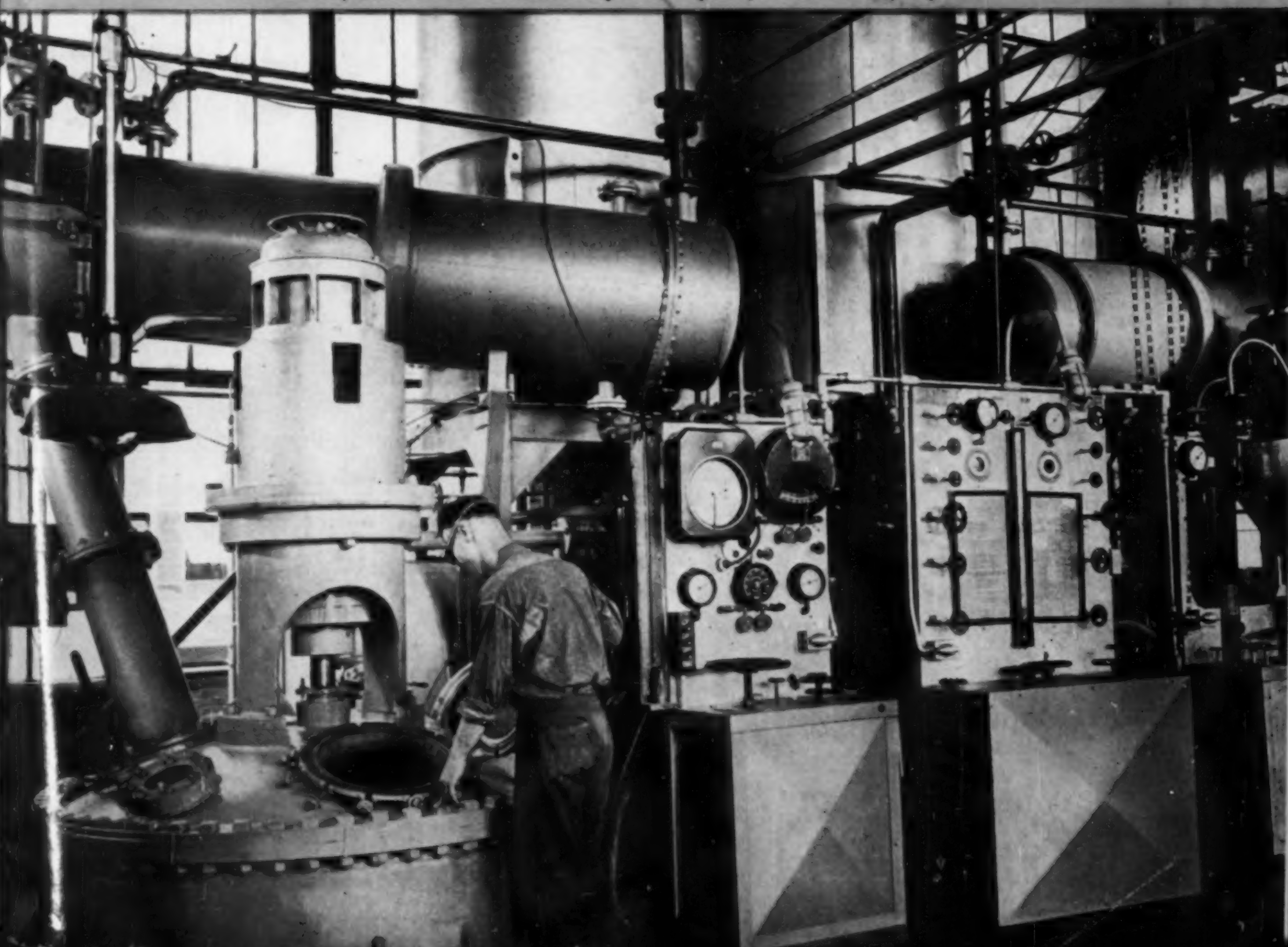
MAR 28 1944

CHEMICAL
& Metallurgical
ENGINEERING

For MARCH, 1944 • GAS TURBINES FOR PROCESS USE • PENICILLIN INDUSTRY HAS GROWING PAINS • POSTWAR PLANS FOR RECONDITIONING WARTIME STRUCTURES • PLASTICS AND CHEMICALS INTER-RELATIONSHIP • ENGINEERS IN WAR AND POSTWAR CHEMICAL INDUSTRY • NEW DEPARTMENT, "WATCHING WASHINGTON," STARTS ON P. 84

Section of still room at Bakelite Corp.'s resin plant, Bound Brook, N. J.



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● *At the same time* the Votator efficiently heats or cools liquids and viscous materials . . . it mixes, blends, emulsifies, aerates or plasticizes. *At the same time* the Votator steps-up production . . . it saves equipment, space and labor. *At the same time* the Votator improves quality . . . it offers continuous, enclosed, sanitary, controlled processing.

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The Girdler Corporation, Votator Division, Louisville, Kentucky.

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THE Votator

A GIRDLER PRODUCT

SOLVAY*

...Keyed to Today and Tomorrow!

Official U. S. Navy Photo

Today ... Solvay Alkalies are all mobilized for Victory Production! They are a vital, basic factor in the construction of war materiel. Caustic Soda, Soda Ash and many other vital and related products are now being supplied from three strategically located plants. Established in 1881, Solvay is America's largest producer of alkalies.

Tomorrow ... Solvay products will contribute immeasurably to chemical achievements that will enrich the world of tomorrow. Drawing upon its extensive resources, broad and varied experience and continuous research, Solvay will produce the finest alkalies. As in the past, its resources of technical knowledge and services will be available to industry.

SOLVAY

TRADE MARK REG. U. S. PAT. OFF.

* The Solvay Process Company employs salt, limestone and ammonia to make Soda Ash, from which basic material Caustic soda and other alkalies are derived.

SODA ASH • CAUSTIC SODA

AMMONIUM CHLORIDE • CAUSTIC POTASH

MODIFIED SODAS • AMMONIUM BICARBONATE

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WATCHING WASHINGTON

R. S. McBRIDE, Editorial Consultant • PAUL WOOTON, Chief of McGraw-Hill Washington Bureau • MALCOLM BURTON, Washington Correspondent

Here is your chance to buy a war plant . . . Congress appropriates $30,000,000 for development of synthetic fuels . . . Dewey announces $30,000,000 expenditure for modifications to make synthetic rubber plants more efficient . . . A hunt is on in New Mexico for more potash reserves . . . Specialized training program for engineers has been cancelled . . . Sulphur will move to market by a new route . . . Barium chemicals are giving Washington concern . . . Federal Trade Commission challenges advertising . . . Rye may be substituted as a raw material for some alcohol manufacture . . . Difficulties in Army contract cancellation clauses.

SELLING ARMY PLANTS

THE WAR Department is working out a definite procedure for the disposal of surplus manufacturing capacity which has been used during the war period for making Ordnance, Chemical Warfare, or other materials, and which is now an excess capacity no longer required by the Army.

What might be called process industry facilities are already being so identified for disposal in the case of TNT, smokeless powder, shell filling, and related equipment. Included are facilities for the manufacture of ammonia, sulphuric acid, nitric acid, and a variety of explosives. All of these projects will apparently be handled by a division in the Office of the Chief of Engineers headed by O. S. Sieder, the only civilian chief of any major part of the Engineer Corps.

MORE OIL FOR PAINT

EVIDENTLY believing in the old adage, "If at first you don't succeed, try, try again," the paint industry has been successful in promoting a 16 percent increase in the allocation of fats and oils for the current quarter. The increase from 60 to 70 percent of the average used in the corresponding calendar quarter of 1940 and 1941 applies to essential paints, varnishes, lacquers and other protective coatings, linoleum, oilcloth, felt base floor coverings and coated fabrics.

The increase is granted for the first quarter of this year only, but provision is made to carry over into the second quarter any unused portions of the first quarter's allocation. It is a hope that a similar increase in the allocation will be made for the second quarter if the relation of supply and requirements for linseed oil remains approximately the same and the future picture continues to be unclouded. But in late February indications were that the allocation rate would be dropped back to the 60 percent level in the second quarter. Shortage of chromium and titanium oxide pigments will bring an increase in lead and zinc combinations and some lithopone combinations.

The amendment to FDO 42 which controls the use of fats and oils also removes from restriction finishes for containers, closures and closure liners for foods, drugs, beverages and pharmaceuticals.

MRO RATINGS PUT ON SAME BASIS

ACTION has been taken to prevent war plants from extending their AA-1 and AA-2 blanket ratings for maintenance, repair and operating supplies. In effect it has put all MRO ratings on the same basis. This has been accomplished by an amendment to Direction No. 5 of Priorities Regulation No. 3.

The practice of war plants in the chemical industry of extending their blanket ratings for their maintenance and operating supplies brought about a maldistribution of some of the chemicals and resulted in their being placed under allocation. Under the new procedure it is hoped that the difficulties that have resulted in some of the allocations can be avoided elsewhere. There even is hope that the distribution problems can be alleviated sufficiently to permit a relaxation or total abandonment of some of the allocation orders. At the present this remains only a hope.

SYNTHETIC FUELS AUTHORIZED

THE House of Representatives late in February voted approval of the bill which authorizes the U. S. Bureau of Mines to build demonstration plants for manufacture of synthetic liquid fuels from coal, oil shale, and lignite. The House also authorized comparable investigations on agricultural and forest raw materials. The appropriations authorized by the bill, which was previously approved by the Senate, are $30,000,000. Only a small part of this will be used in the coming fiscal year, it is expected. Early projects contemplate a pilot unit test of the Fischer-Tropsch process at Bruceton, Penn., and further determination of necessary engineering data for the design of a Bergius process plant for hydrogenation of coal. It is not expected that actual demonstration plants will be built during the first year. However, design work will begin and substantial expenditure for such demonstration plants of commercial size will be undertaken in the second or third year. As initiated, the program contemplates five years of experimental and demonstration work, with no intimation as to plans thereafter.

RUBBER TRENDS NOTICED

SYNTHETIC rubber supplies, though more adequate now than every before, are still less than the urgent demand for military and civilian applications. Hence almost daily Washington announces modified rulings and forecasts. Rubber Director Bradley Dewey announced that the January production of synthetic rubber was 50,000 tons; but he forecast that the average output for the second half of 1944 would be about 75,000 tons per month.

Efforts are being continued to get as much natural rubber as possible. Rubber Development Corp. announced an increase by one-third in the price for natural rubber from Brazil which was originally established in 1942. The recent price has been approximately 45c. per lb.

Scrap rubber collections since 1942 amount to about 750,000 tons, of which about 35,000 tons per month is being used.

Neoprene and special rubber supplies continue in greater demand than supply. Hence more stringent restrictions were imposed recently on neoprene and neoprene cement. These restrictions have become necessary despite the expectation of some months ago that these special rubbers would be more abundant at this time. Allocations continue in accordance with end-product uses.

The new synthetic rubber plant at Port Neches, Texas, has been dedicated with total capacity shortly operable of 120,000 tons of butadiene per year. That is one-seventh of the country's wartime demand. In connection with this and other synthetic developments Washington has also been making a great point of the large requirement for industrial soap for use in Buna-S making. The slogan is almost "no soap, no rubber." Approximately 100,000,000 lb. of soap are used annually in the synthetic rubber program which is a new market for soap.

BUNA S PLANT IMPROVEMENT

EXPENDITURE of $30,000,000 to improve plants producing synthetic rubber during the year 1944 was announced by Bradley Dewey, rubber director, in mid-February. This expenditure is for the pur-

It's easy to secure the advantages of **VARIABLE SPEED** *operation*

MASTER SPEEDRANGERS

Mighty impressive is the number of companies who are using large numbers of Master Speedrangers. They have found that the many advantages of variable speed operation can be secured more easily by using this drive.

It's easier because the Speedranger is a compact integral unit . . . only one unit to mount . . . saves space, saves money.

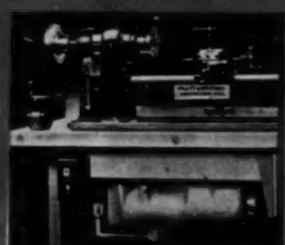
It's easier because Speedrangers are available for every current specification, every type enclosure, with gearheads, unibrakes . . . and in the whole wide range of types in the Master line. This wide flexibility makes it easier to secure just the right drive for each installation.

And it's easier to keep right on enjoying these advantages because the all-metal construction of the Speedranger insures much longer trouble free service than units in which less durable materials are used. In addition, the complete Speedranger is designed and manufactured as a unit in one plant by one manufacturer, so there is no division of responsibility for its satisfactory operation.

Investigate how easily you can secure the many advantages of variable speed operation if you use Master Speedrangers.

THE MASTER ELECTRIC COMPANY • DAYTON 1, OHIO

Each of the Speedrangers on this installation is supplied for ceiling mounting, and in addition, has provision for manual remote control of the speed.



pose of changing designs and making minor additions to bring about a more efficient operation of some of the units. Butadiene from alcohol facilities has been allocated $3,000,000 and butadiene from petroleum $10,000,000. Styrene plants will receive $3,000,000 and copolymer plants $10,000,000. The sum of $3,000,000 will be distributed to butyl facilities and $1,000,000 will be used for miscellaneous improvements. In making the announcement, Director Dewey emphatically stated that the projects are in no sense an expansion of the synthetic program.

POSTWAR PLANS MERGED

Cooperation in postwar planning between labor and management, between management and agriculture, and between all three and career officials of the government is now observable in Washington. A few politically minded officials still play one group against another. But many legislators and most career executives of departments, including the military, recognize that all groups have a common problem in finding an equitable, workable basis for readjustment. Perhaps the most conspicuous leader of cooperative effort is Eric Johnston, president of the Chamber of Commerce of the United States. His organization, abandoning the old guard philosophy, is proving something of a rallying ground for the meeting of what were formerly conflicting interests.

POTASH DRILLING PLANNED

Using the inflated estimates of potash demand furnished by zealous spokesmen for agriculture, the Department of Interior is planning further explorations for potash this spring. Late in February they took bids for drilling certain areas in New Mexico near Carlsbad intending to block out reserves there. The Department obviously hopes that minable occurrences will be proven by a dozen or more core drillings in an area where one or two wells have shown a small occurrence.

Plenty of criticism has been offered of this hasty plan. Some object to the diversion of funds from other mineral investigation. Others charge that it is merely an effort to use claimed shortages of potash for doing work which Congress would not approve at this time through direct appropriation. There is, however, no criticism of the idea that soon after the war there should be approval for drilling further to block out potash reserves in the Carlsbad area.

Most bitter are the critics who claim that it is a further effort of the Department of Interior to get the government into the mining business. This latter charge arises principally from the nonpreference of those backing this plan. They, in previous undertakings, have sought to establish the equivalent to TVA for other minerals and other power areas.

Some of the talk even implies that if the Department proves the minable occurrence of potash mineral they will undertake to use it as a club over present producers. This interpretation comes at least in part from the efforts made heretofore to secure a cut in the price of potash. Whatsoever the motive, it is evident that these officials do not intend to use present abundant hoisting capacity by urging the building with government money of more refineries.

The present hoisting capacity would certainly equal a million tons per year of K_2O. The refinery capacity is about three quarters of this amount. The refineries are now supplying all immediate demands; but obviously cannot meet the extreme of requirement estimated for the next fertilizer year (1944-1945) which some enthusiasts say should be as much as a million tons of K_2O. It is stated that the only way this larger production could be reached in time would be to build new refineries for processing the larger quantities of low-grade mineral which can be hoisted from proven reserves already being worked.

MORE POTASH AVAILABLE

During February more potash became available for agriculture. Additional supplies will make 580,000 short tons of K_2O available for the current fertilizer year. Allocations for chemical usage are now 100,000 tons of K_2O, an all-time record.

MOLASSES AGREEMENT MADE

Negotiations at Havana by United States representatives provide for better working relations between this country and Cuba on blackstrap molasses and industrial alcohol. The agreement for 1944 includes the following four provisions:

1. The United States is to purchase an initial minimum of 65,000,000 gal. of blackstrap molasses, at 13.6 c. per gal. base and with other terms and conditions similar to those in the 1944 invert molasses contract.

2. The United States is to purchase up to 12,500,000 gal. of 190 proof industrial alcohol, at 65 c. per gal., f.o.b. Havana, Cuba. To the extent that any of this alcohol is not produced by Cuban distilleries, Cuba has agreed to sell the United States the molasses which would have been required to produce it.

3. An estimated 85,000,000 gal. of blackstrap molasses will be required to produce the alcohol necessary for Cuban domestic motor fuel (carburante) and for Cuban industrial uses.

4. Cuba has agreed that the export of beverage alcohol to the United States in 1944 will not exceed the amount imported into the United States from Cuba during 1943—approximately 14,300,000 proof gal.

It is hoped that additional molasses above the initial minimum provided in paragraph one will be available either as blackstrap or more alcohol. Perhaps as much as 8,000,000 gal. of industrial alcohol may be so supplied.

ENGINEER TRAINING CANCELLED

Urgent need of young brain power in the combat forces compelled cancelation during February of most plans under Army Specialized Training Program contracts. A few advanced students of engineering as well as medical training groups at several levels are to be continued. But the flow of engineers from the basic groups into professional training is likely to be completely cut off by or soon after April 1. Few chemical engineering students will be affected as the groups in this specialty were small. The change in the Army program will probably not stop the plan for exemption of a few civilians to take engineering courses under the National Roster's quotas described in *Chem. & Met.* last month.

INDUSTRY TO BE HEARD

An official announcement of WPB states that "no limitation or conservation order or amendment may be issued without prior consultation with an industry advisory committee if the change will result in a substantial alteration in the operations of that industry."

The new order also points out that it is the duty of WPB to protect the representatives of industry against anti-trust prosecution which might grow out of their active cooperation if it were not arranged in the interest of the public and in cooperation with the government. It is emphasized that such group action must be limited to the needs of the government and the public, or immunity from prosecution cannot be promised where improper agreements are being entered into.

NATURAL GAS SHORTAGE

Industrial users of natural gas have been cut off from supplies of this fuel in a number of areas. It is believed that from February through April there may be serious difficulties recurring in the territory extending from Missouri to the Eastern Seaboard, insofar as this territory gets natural gas. But forecasters who seem to know what they are talking about say that this difficulty will not occur again next year, as completion of pipelines into the Eastern territory will be accomplished late in the Spring. Obviously, the shortage will not be serious in summer as the space-heating demands of the warm months are small, and space heating has been the cause of most of the peak demands which have gone beyond the capacity of pipelines.

MORE AEROSOLS PROMISED

Army need for insect sprays to control mosquito-borne malaria and worse diseases has been emphasized by the tremendous number of casualties from exposures in Africa and the Pacific war areas. Strenuous efforts have been made, therefore, to increase both the propellent production and the manufacture of substitutes for pyrethrum. During February it was announced that Du Pont would build a large plant for manufacture of DDT (dichlorodiphenyltrichloroethane). This is the Geigy product which has been most widely accepted in recent months as an almost adequate replacement material for pyrethrum. It is used also very effectively as a dust on clothing to give protection againt body lice.

WPB has also announced plans for the new production by Du Pont of Freon. That refrigerant gas is the dispersing agent used in the aerosol bombs. After the new capacity is completed at Deep-

CERATHERM · A NEW CHEMICAL STONEWARE

UNAFFECTED BY VIOLENT *Thermal Shocks*

LOW IN POROSITY
HIGH IN STRENGTH
•
HANDLES ALL CORROSIVES*

	Typical Commercial Chemical Stoneware	New Normal Service "U. S." Chemical Stoneware	Ceratherm 500	Ceratherm 750
POROSITY	2.5	0.3	0.5	1.5
MODULUS OF RUPTURE (lbs. per sq. inch)	4900	6200	6500	6900
COMPRESSIVE STRENGTH (lbs. per sq. inch)	45,000	63,600	78,000	82,800
RELATIVE PERCENTAGE OF LOSS OF STRENGTH IN U. S. S. CO. STANDARD QUENCH TESTS	Failure	90%	15%	5%
RELATIVE IMPACT-SHOCK RESISTANCE	1.0	1.45	1.78	1.96

Chart comparing physical properties of Ceratherm 500 and Ceratherm 750 with new normal service U. S. Standard Chemical Stoneware and with typical Commercial chemical stoneware.

A glance at the chart will tell you why engineers are specifying chemical equipment made from the new Ceratherms, the amazing dense-bodied, heat-shock resistant chemical stoneware.

Here for the first time is a chemical stoneware, rugged and strong, a body that doesn't have to be handled with kid gloves, a body able to withstand abrupt changes in temperature up to as high as 750 degrees F.

The new Ceratherms retain all of chemical stoneware's well-known advantages: ease of fabrication, low cost, unrivalled corrosion-resistance, freedom from contamination.

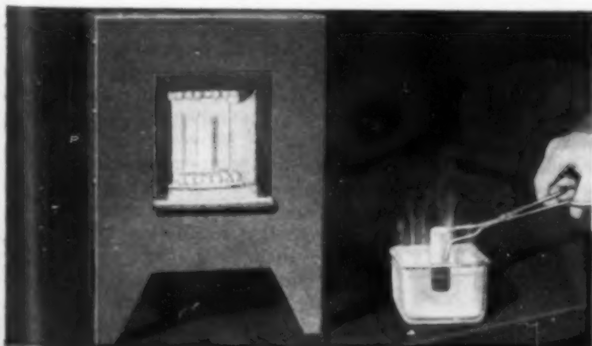
Specify Ceratherm for such products as these:

Pumps, Suction Filters, Cooling and Condensing Coils, Tanks, Jars, Pots, Pipe, Fittings, Laboratory Sinks, Ventilating Pipe and Exhausters.

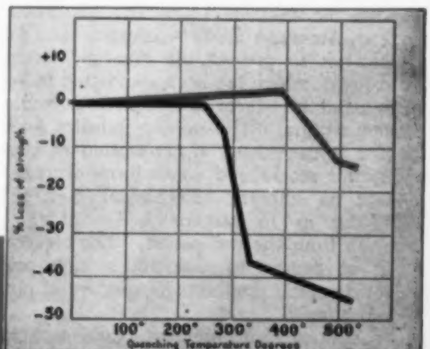
Write for new Bulletin today!

**With the exception of hot caustics and hydrofluoric acid, these new Ceratherms will handle all acids, alkalies and solvents in any concentration.*

U. S. STONEWARE
Since 1865 - Akron, Ohio



Ceratherm actually shows an increase in mechanical strength (note chart at right) when heated to 400 degrees F. and quenched—more than 100 degrees beyond the point where ordinary bodies begin to lose strength.



water, N. J., and East Chicago, Ind., the monthly production of Freon will be 4,800,000 lb. The new output will also permit extension of the supply of this chemical to refrigerant users who have been working on restricted supplies recently.

Aggressive work is also being done by the Army to supply mosquito repellents for use on the skin of soldiers while actively in the field in infested areas. These are employed in either lotion or other forms to minimize the danger of bites by typhus-bearing or malarial insects. Several satisfactory synthetic repellents have been developed by chemical research guided by practical field tests under the direction of entomologists.

INSECTICIDE NEED IS LARGE

Every available raw material for insecticide manufacture is being carefully conserved this year for urgent needs in agriculture, victory gardens, and health and sanitary uses at home as well as for the Army. Arsenic, though still scarce, will come much nearer this year to meeting agricultural and victory garden needs, according to WPB's February estimates. That agency has even withdrawn its objection to the use of arsenicals for shade trees, nurseries, lawns, and golf courses. With reference to their packaging, insecticides have been accorded considerable preference aid, thus permitting the use of steel drums, bottles, bottle closures, and even multiwall bags.

GOVERNMENT SHIPMENTS TAXED

Many shipments of government goods are being taxed 3 percent of the freight charge through error. The Internal Revenue Regulations provide in Section 3475 that property owned by, or shipped for, the federal government, any state, any political subdivision thereof, or the District of Columbia is exempt from this transportation tax. Shippers are warned that they should not pay such tax, as they are not permitted to re-collect from the government.

STOCKPILE LEGISLATION

Members of Congress from the western mining states have thus far dominated the thinking and the planning for legislation regarding postwar mineral stockpiles. These legislators are centering their efforts on support of S. 1582, proposed by Senator Scrugham of Nevada. That bill, if enacted, would provide for the building of huge mineral stockpiles with surpluses from the war period plus some production from American mineral occurrences. The effort is to prevent the domestic mining industry, which has been stimulated by war demand for scarce minerals, from finding competition. The mining industry hopes that it can secure a sterilization of these surplus stocks and some form of restriction on imports. Legislation even goes so far as to prevent free working of scrap from the war period. The objective is, of course, to maintain a high price for domestic producers irrespective of postwar supply.

A somewhat different view was expressed by W. L. Batt, vice-chairman of WPB, in a recent address in which he stated that after the war we will have a surplus of ships and of manufactured goods. We will have goods to sell and facilities for shipping them to countries where they will be sorely needed but where the ability to pay for them will be doubtful. Batt suggested that in return for such shipments abroad, we accept payment in the form of imports of critical materials. He pointed out that this country no longer had unlimited supplies of low cost iron, zinc, and copper, that our petroleum reserves had been strained and that we never had much high-grade bauxite, nickel, or tin. Under proper controls, he felt that imports of vital materials would be helpful not only in conserving our dwindling supplies but also in creating stockpiles for emergency use.

STARCH PRICE RAISED

The ceiling price on corn starch and dextrine products in bulk was raised by OPA during February by 62c. per 100 lb. Compounded materials containing starch or dextrine may be increased in price in proportion to the content of these materials.

This price rise is made in partial compensation for the rise in price of corn, which went up about 34c. per bushel between March, 1942, and the present. It takes three bushels of corn to make 100 lb. of starch or dextrine. Hence the increase in cost from corn alone amounted to $1.02 per 100 lb. of finished product. The fact that a majority of the 11 companies making these products were operating currently at a loss was the persuasive argument used by the industry in getting this permission of OPA to raise the ceiling.

NEW SULPHUR ROUTE

About a quarter-million tons of sulphur will be moved from Louisiana and Texas to the New York Harbor by Federal Barge Line in new steel barges. This sulphur will move by way of the Mississippi River, the Great Lakes, and the Erie Canal to supply normal sulphur requirements of the Eastern States. The movement will begin as soon as navigation is possible in the spring and will be completed before the freeze-up in the fall. Coastwise ships are thus released for the hauling of coal, a transportation need that is exceeding ship capacity.

SMALL BUSINESS FIRST

Small business establishments are to be given preference when surplus materials are available beyond the need for immediate war or war stockpile purposes. Chairman Donald M. Nelson of WPB announced this as a part of the effort of his organization to protect or re-establish small enterprise which has suffered serious disturbances during the war period. Recognizing "You have had many heartaches and the job ahead is a difficult one", he pointed out that the purpose of this plan is to provide small companies with an opportunity to use their own initiative and ingenuity. It is definitely not a subsidy, but a bit of a head start in reconversion.

BARITE SCARCITY

Washington is beginning to worry about the scarcity of barite and barium chemicals. The prospective shortage is caused by having too few trucks and too little mining equipment for the mining division of this industry. It now appears necessary to give much higher priority in order to insure repairs and replacements promptly.

ADVERTISING CHALLENGED

Federal Trade Commission proceedings have been started against a leading soap company demanding a change in the advertising practices of that firm. It is charged that the advertising has "misrepresented" the goods sold. If the Commission can make its plans stick, it proposes to go into the courts and compel the elimination of all the charm and distinctive service claims which are commonly associated with toiletries, cosmetic materials, and other such products. The whole matter is significant for the process industries because this is only one symptom of the trend of F.T.C. toward domination of all merchandising practices, including censorship of the text of advertising "copy".

ALCOHOL FROM RYE

Rye is slightly more abundant than wheat, corn, or barley, and War Food Administration would like to substitute it as a raw material for some alcohol manufacture. Early reports from industry indicated that this substitution would reduce the capacity of alcohol plants. Hence a joint inquiry is being conducted by WPB and WFA to determine both feasibility and desirability of this change of raw material.

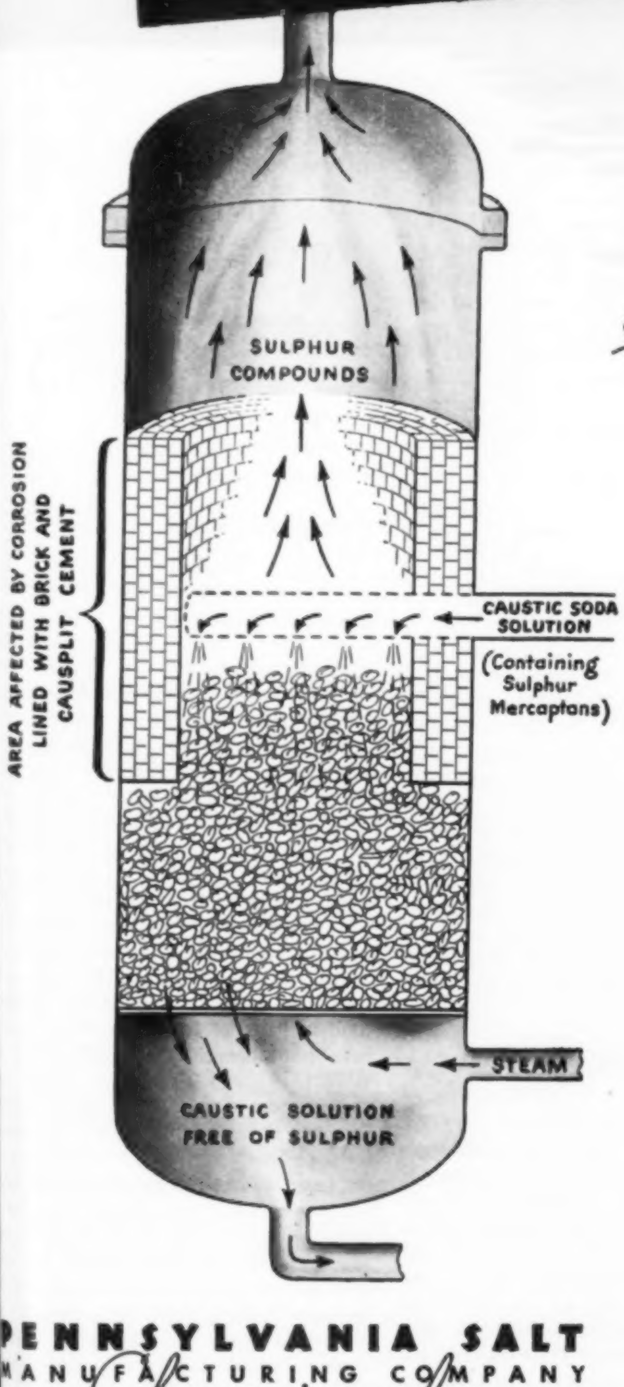
Initial tests include experiments with various types of granular rye flour. It is hoped that some of the industrial establishments making tests for the government will develop a know-how suitable for use with some of the types of raw material which can readily be made available from existing flour mills. No decision as to the quantity of change-over which will be planned can be attempted until results are had from several weeks' experimental work, first on a laboratory scale and then on a plant scale.

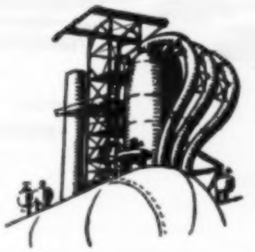
CANCELLATION CLAUSES

Subcontractors supplying raw materials such as chemicals find difficulty in dealing with Army business. The military place prime contracts with certain cancellation clauses. They then go out and stimulate material suppliers to enlarged activity so that the prime contractor will not be delayed by lack of raw materials. But the Army does not give any formal authorization for expansion of the materials business. Mere assurance of need of the goods is not an enforceable contract. Chemical manufacturers are finding it difficult and are seeking for some form of real order so that sudden cancellation will not leave them with large amounts of goods in process or in inventory without any market. Prime contractors are being asked to demand for their subcontractors a suitable protection of this sort.

When repairs call for ACTION
--depend on PENNSALT CAUSPLIT CEMENT

REG. U. S. PAT. OFF.





At a leading oil refinery emergency repairs were required on the lining of a Mercaptan Tower . . . because of sulphur erosion at the intake area.

The engineers in charge thought they were faced with a three-day shut-down for repairs, with the resultant loss of production.

A Penn Salt technician was called in and after going over the situation he recommended Causplit Cement in conjunction with corrosion-resistant brick. He gave installation instructions and four courses of the brick were used with Causplit Cement as the bonding material throughout. Drying was speeded by heating the tower to 100 degrees F. *and the equipment was back in service the next day!*

Pennsalt Causplit* and Asplit* are resin cements —exceptionally strong, abrasion-resistant and easy to handle. Causplit is used where conditions are alternately acid and alkali . . . Asplit where conditions are always acid.

Pennsalt Penchlor* Acid-proof Cement is a quick-setting, self-hardening sodium silicate cement that will save time in construction and stand up well under severe acid conditions.

Consult Penn Salt technicians about *your* acid or alkali handling problems. Their wide experience is available without obligation. Write fully or return the coupon.

Causplit and Asplit can be supplied only for essential service . . . Penchlor Acid-proof Cement is available without restriction.

PENNSYLVANIA SALT MANUFACTURING COMPANY
Chemicals

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New York • Chicago • St. Louis • Pittsburgh • Minneapolis • Wyandotte • Tacoma

PENNSYLVANIA SALT MANUFACTURING COMPANY
Dept.CME, 1000 Widener Bldg., Philadelphia 7, Pa.
I would like to have a free copy of your new booklet No. 6 on Penchlor Acid-proof Cement.

NAME______________________
TITLE______________________
COMPANY______________________
ADDRESS______________________

*Trade-marks Reg. U. S. Pat. Off.

INTERPRETATIONS

This installment covers orders rules and regulations issued by the War Production Board and the Office of Price Administration during February, 1944. Copies of each item interpreted here may be obtained from the appropriate federal agency.

CITRIC ACID

QUARTERLY ALLOCATION of citric acid will replace monthly allocation as a result of shifting control to General Allocation Order M-300. Order M-321 which formerly controlled citric acid has been revoked.

PEROXIDE AND PERBORATE

HYDROGEN PEROXIDE, sodium peroxide and sodium perborate have also been placed under control of General Allocation Order M-300 after three months control by WPB directive. A substantial cut in consumption is required in order to balance supplies and requirements. Use of the product for such vital applications as antiseptics will not be seriously curtailed, but textile finishing and other less essential processes will be forced to take a big cut in consumption of these products.

NAPHTHAS AND SOLVENTS

INDUSTRIAL NAPHTHAS and solvents have been placed under the price control of MPR-510. Previously they were under MPR-88, but have been shifted in order to eliminate any misunderstanding in connection with the base price period. All the products under Regulation 88 have the base period of October, 1941, whereas naphtha and solvent prices are based on March, 1942.

RUBBER COATED FABRICS

OPA HAS ISSUED an order under MPR-478 to provide manufacturers of rubber coated fabrics with a method for determining the price of their products when they substitute a more expensive coating material. For instance, when Buna-N is substituted for neoprene GR-M or GN, manufacturers may add to their prices an amount not exceeding the increase in cost of rubber, thus eliminating the need for individual applications. As yet, price changes due to other substitutions must be established as formerly.

VALVES, FLOATS AND TRAPS

ELIMINATION OF SOME simplification and standardization in the manufacture of radiator supply valves, low-pressure thermostatic radiator traps, combination float and thermostatic traps and boiler return traps was accomplished by amendment to Order L-42, Schedule VIII. This action was taken because simplified models have not proved satisfactory in all cases. Former restrictions as to sizes, design, patterns and types of low-pressure thermostatic radiator and drip traps, combination float and thermostatic traps and boiler return traps have been removed, except that the bodies of these items are still required to be made of cast iron.

DEGREASERS ALLOCATED

TRICHLORETHYLENE, used extensively for degreasing metal, and perchlorethylene, important ingredient of smoke generating materials, were placed under allocation for the first time on February 11 by WPB. Order M-371, issued to control the allocation, provides that each person ordering more than 700 lb. of these products in the aggregate during any one month shall furnish each supplier with a use-certificate in accordance with Appendix C of the Order. For orders of 10,000 lb. or more, the customer must file a report on Form WPB-3442 on or before the twentieth day of the month preceding date of delivery. Suppliers receive authorization from WPB by submitting their application on Form WPB-3947.

COPPER FOR CONDENSERS

RESTRICTIONS ON the use of copper and copper base alloys that have limited the inclusion of these metals in the manufacture of tube and tube sheets for steam condensers have been lifted by WPB. It is expected that the use of copper will lengthen the average useful life of condenser tubes and sheets, eliminate costly shutdowns, and reduce the quantities of replacement and maintenance parts which were necessary as a result of the unsatisfactory performance of alternate materials. The lifting of restrictions was effected by amendment of Limitation Order No. L-154, Schedule II.

STEEL CYLINDER DEMURRAGE

IN AN ATTEMPT to speed the return of empty compressed gas cylinders, the OPA has provided all sellers of compressed gas with a means of charging demurrage for each additional day a cylinder is retained by buyers beyond the normal period necessary to empty the cylinder. Revised Supplementary Regulation 14 to the GMPR, Amendment 89, provides that any seller instituting or modifying a cylinder demurrage charge must furnish the buyer with a written notice that OPA has given permission for the charge.

PHENOLIC RESINS

GENERAL PREFERENCE ORDER M-246, which covers phenolic resins and phenolic resin molding compounds, was simplified by WPB on February 15 to save paper work. This latest revision puts application for allocation of plywood, laminates and specialties on a quarterly rather than a monthly basis. End use certificates are no longer necessary if the product manufacturer can determine the end use from the nature of the customer's purchase order. In addition, a purchaser may use up to 2,000 lb. of phenolic resin in any end product which was previously described by him on his Form WPB-2945 under Order M-246, and approved in writing by WPB at any time since Sept. 30, 1943. The above permission does not apply to cast phenolic resins, phenolic resins containing tung oil or para phenyl phenol, or resins in which para tertiary butyl phenol is the sole phenolic reactant. A 50 lb. small order provision is applicable to cast phenolic and a 5 lb. exemption has been added for the latter resins.

Para phenyl phenol resins have been consolidated in this Order for the first time, permitting the revocation of Order M-254 under which they were formerly allocated. Resorcinol resins are not included in the Order since their high prices prohibit their use in non-essential products.

OTHER CONTROLS

IN ORDER to relieve the demand for maleic resins, Conservation Order M-5 has been amended to permit application to be made for allocation of **phenolic resin** for use in printing inks....Chemical **cotton linters** have been redefined as linters sold on the basis of cellulose content as determined by chemical analysis, whereas free cotton linters are defined now as those sold not on the basis of cellulose content, but according to the grade set forth in amended MPR No. 191....Application for authorization to sell, transfer or convert **industrial power trucks** under Limitation Order L-112 must be made on Form WPB-1319 in accordance with instructions currently available with the form....The authorized form for delivery of **resistance welding equipment** under Limitation Order L-29 has been changed from WPB-2752 to WPB-1319....Reserve production capacity under Conservation Order M-24 has been increased from 35 to 45 percent for **paperboard,** and from 15 to 20 percent for **paper**....**Anhydrous aluminum chloride** may now be furnished by a supplier in quantities of 600 lb. or less to each customer, except to those whom the supplier has reason to believe are not entitled to accept delivery under the exemption included in Order No. M-287....**Yellow cypress lumber** has been provided with dollars and cents ceiling prices by OPA through issuance of MPR-513....Amendment to Conservation Order M-6-b makes available for all purposes permitted by existing regulations, **nickel anodes,** nickel **salts** and plating solutions which were frozen in nickel platers' inventories on Jan. 20, 1942.

CHEMICAL
& Metallurgical
ENGINEERING

ESTABLISHED 1902 MARCH, 1944 S. D. KIRKPATRICK, Editor

From War Plants to Cornfields

DEMOBILIZATION of chemical industry has already begun. Late last month the workers started tearing down the great Gopher Ordnance Works at Rosemount, Minn., thereby releasing more than 20,000 acres of fertile farmland for needed food production. The wrecking crews, according to Time magazine, found sardonic pleasure in putting into reverse the 1942 boasting of many Midwestern munition plants. "You'd never believe it," they said, "but this cornfield was once a war plant!"

Thus begins a long unravelling, unscrambling process that is bound to bring with it some serious problems for all of us. They loom even larger than the original program of providing facilities for war production. Looking back now it is easy to see how far we over-planned and over-built but we must realize that these powder plants were put up at a time when we were faced with the possible necessity for supplying the munition requirements of England and Russia as well as our own. Hence we can and should charge off many of these tremendous expenditures as insurance against an international danger that no longer exists. Now their demobilization brings with it a domestic danger that is not yet fully appreciated.

That danger is political more than it is economic or technical. Pressure groups are already working to force the disposition or continued operation of these plants in order to serve the selfish interests of local communities or larger regional units. We need but think back to the agitation over Muscle Shoals in the twenties to realize how many TVA's would be needed to take care of our present commitments were we to adopt the political solution for the problem of the forties. The better course is that which has been charted in broad outline in the recent report on War and Post-war Adjustment Policies by Bernard M. Baruch and his associate, John M. Hancock.

They would put the job largely up to the private initiative and resourcefulness of American industry in order to make certain that there would be no surrender to Governmental control and inevitable socialization of business. They would have the Congress set up the reconversion agencies and define by law their functions, powers and responsibilities. Thus they would avoid, if possible, the instability and uncertainty that have characterized so many of the wartime agencies that have been set up by executive decree with "blank-check" appropriations but with vaguely defined fields of authority.

Unfortunately President Roosevelt did not see fit to wait for Congressional action on the Baruch-Hancock report but instead proceeded immediately with the appointment of key personnel to put its recommendations into effect. The selection of Will Clayton to become Surplus Property Administrator and of General Hines to direct retraining and re-employment has met with little enthusiasm yet both are able public servants who can be expected to do their best in the difficult jobs to which they have been assigned. Yet their work would have been much more effective and they would have been under less political pressure had the President waited for Congress to have created an enduring legal framework for this new agency.

Those who are most pessimistic feel that demobilization is going to have to proceed on the same trial-and-error basis that characterized the mobilization of our war effort during 1941 and 1942. If so, we may expect an accumulation of political pressures that will make the winning of the peace much more difficult—if not impossible. It is better by far that we now move slowly but surely. Let us chart our immediate and longtime objectives, set up a sound program, industry by industry, and then give it the power and stability of federal law.

STANLEY A. TUCKER *Associate Editor, Power, New York, N. Y.*

GAS TURBINES

Offer Opportunities for Process Use

Although the gas turbine has been well known in the petroleum industry for the past seven years, where some 35 are now used as an auxiliary to the Houdry process, interest is rapidly increasing owing, perhaps, to dramatic announcements in connection with their use in jet propulsion for aircraft, and in airplane engine supercharging. As the most versatile type of prime mover, the gas turbine can produce compressed air, hot gas and byproduct steam, in addition to power. In some cases it can operate on byproduct heat from exothermic reactions.— ***Editors***

Were it not for the happenstance that the Houdry refining process requires large volumes of air under pressure for burning off carbon deposits on the catalyst, gas-turbine development in the United States would have been largely confined to internal-combustion engine supercharging. As it is, however, the gas-turbine, axial-compressor combination shown in Fig. 1 has become an essential auxiliary to this process. Some 35 sets in sizes from 23,000 to 60,000 c.f.m. are now in operation, eight built by Brown, Boveri & Co., Ltd., in Baden, Switzerland, and the remainder by Allis-Chalmers Mfg. Co., in Milwaukee.

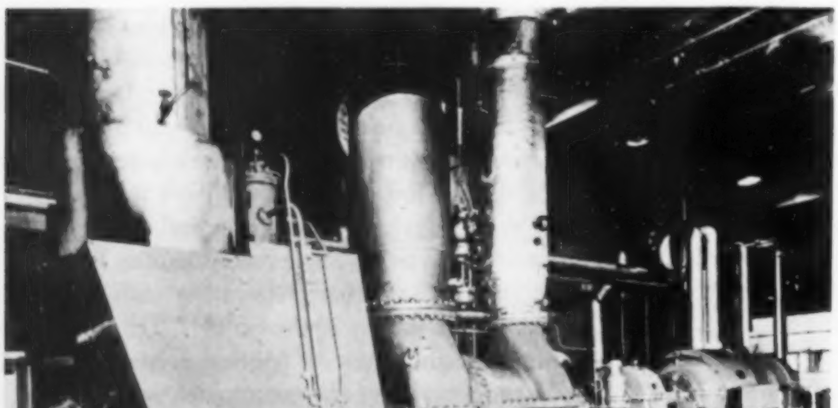
The gas turbine is similar in construction to the low pressure stages of a steam turbine, but instead of operating on steam under pressure, it operates on hot combustion gases under pressure. In this respect it is related to the internal combustion engine. Since the fuel used must be burned under pressure, the combustion air for the gas turbine must be compressed, but the compressor does not require all of the power produced by the turbine, so that a surplus is available for the production of mechanical power, or electricity, or for compressing additional air for process use. The gas turbine is therefore essentially a pressure recovery device, and in this respect bears a resemblance to the well known scheme of pressure recovery used in the scrubbing of CO_2 from the synthesis gases in the synthetic ammonia process.

In this process, as in Fig. 2 (a), the high pressure scrubbing water is pumped into the scrubber tower by a pump which is on the same shaft as a Pelton wheel and a motor. Part of the energy of the water leaving the tower is recovered by the Pelton wheel, while the losses in handling the water are made up by the motor. The comparable case for the gas turbine is shown in Fig. 2 (*b*) where a compressor supplies compressed air to a process, from which the exit gases pass through a gas turbine on the same shaft as the compressor. The pressure losses in the process can be supplied in one of three ways. If the process is exothermic, as in the Houdry process, the leaving gas may contain enough energy to drive the compressor and even leave a surplus. Or a combustion chamber for burning gas or oil in the leaving air can be added. Finally, in the case directly comparable to Fig. 2 (a), the energy not recovered by the gas turbine can be provided by a motor.

While the "application engineering" for gas turbines has hardly begun, there are many indications that the continuous-combustion, compressor-turbine cycle is destined to play an important part in both chemical and metallurgical processes by affording means of completing chemical or physical reactions under pressure. The gas-turbine unit has potentialities far beyond that of a mere competitor of the steam turbine or diesel engine.

For example, the relatively simple process of supplying air for reducing iron ore in a blast furnace is traditionally carried out by burning blast-furnace gas under a steam boiler, expanding the steam through reciprocating engines driving compressors, or a turbine driving a centrifugal blower, and returning blast air to the furnace through preheating stoves. This re-

Fig. 1—One of 35 gas-turbine, axial-compressor sets, a 60,000 c.f.m. unit built by Allis-Chalmers, now serving in a Houdry process refinery



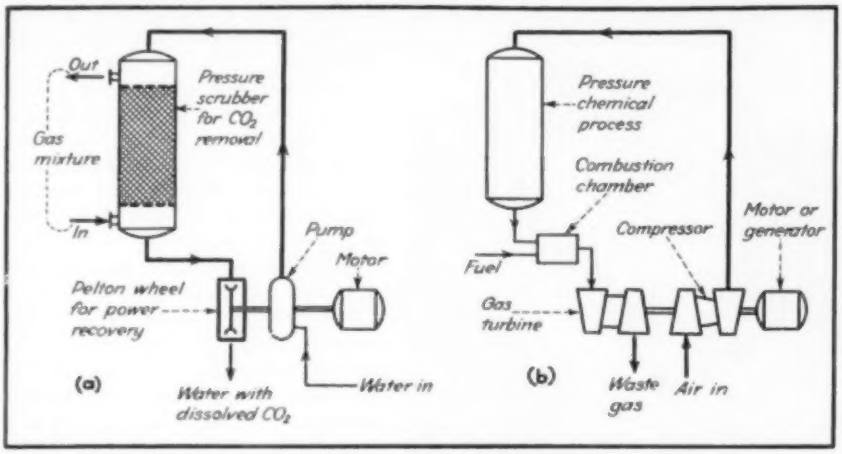


Fig. 2—Essentially a pressure recovery machine the gas turbine is comparable to the Pelton wheel used in partial recovery of the pressure of scrubber water in ammonia synthesis; it can return part of the work to processes operating under pressure

quires considerable building space for boilers, prime movers and compressors, a condensing water supply, and a relatively large investment in equipment. A gas-turbine unit capable of supplying 60,000 c.f.m. of blast air at desired pressure would occupy a space only 60 ft. long by 13 ft. wide, would require no cooling water and would cost only a fraction as much as a steam turbine and boiler installation.

Application in the Houdry process and in iron smelting are only two illustrations of how the gas-turbine unit can perform certain process functions in an entirely different manner from existing practice. Others suggest themselves, such as exothermic pressure oxidation reactions (e.g., oxidation of benzene), but await the realistic evaluation of economic factors that must accompany introduction of radically new devices. In the meantime, forward looking engineers will do well to become acquainted with (1) the fundamentals of the gas cycle, and (2) present forms of equipment which utilize products of combustion directly for the production of mechanical power.

GAS-TURBINE THEORY

The basic equipment for turbine-compressor units such as now used in the Houdry process is illustrated schematically in Fig. 3. On a single shaft are grouped the turbine, the compressor and some means of starting rotation. The generator may be either geared or direct driven depending on the best speed for the compressor. The combustion chamber, limited for the present at least to oil or gas firing, is little more than a piece of pipe. A fuel pump and a combined governor and lubricating oil pump complete the list of auxiliaries. In event of overspeed, a safety valve bypasses hot gas to the exhaust.

Blading of the turbine, shown in Fig. 4, differs little in shape from conventional low pressure stages of steam turbines. The adiabatic efficiency of blading for one unit on test reached 88 percent, equalling that of the steam turbine. Although it must be able to stand high temperatures, however, even for 1,200 deg. F. operation, only the first row of blading has to run continuously at top temperature, as the gas is cooled by performing mechanical work in each stage. Exit gas temperature normally does not exceed 700 deg. F.

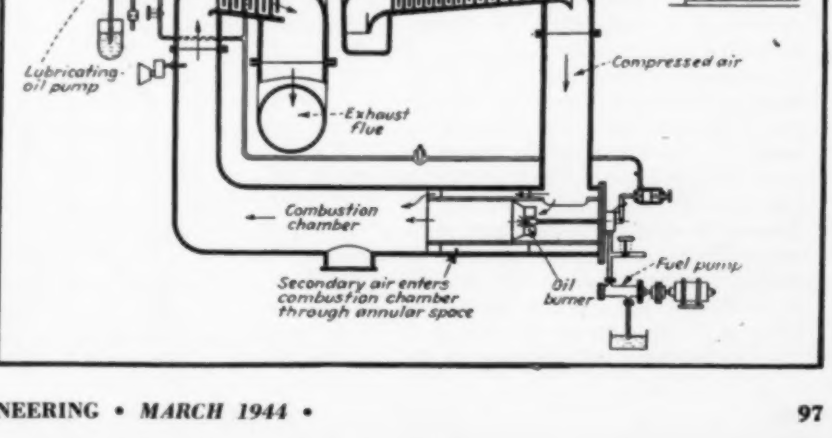
High efficiency is a prime requirement of the compressor, in fact, the inherently low efficiency of centrifugal compressors led to the conclusion in the 1920's that the continuous-combustion process would never be practical. However, aerodynamic research has resulted in greatly improved designs of axial-flow blading and compressors can now be built with over-all efficiency of over 85 percent, adiabatic basis.

In principle, ordinary air is compressed to any convenient pressure, say 60 lb. per sq.in. gage and passed through a combustion chamber where enough oil is fired to bring the "flue" gas up to operating temperature, say 1,200 deg. F. Products of combustion, together with the excess air, expand through the turbine blades to atmosphere. Since more work is available from the expanding high-temperature gas than is required by the low-temperature compression, the turbine has an excess of power available for the generator.

Essentially the same process occurs as in a diesel cylinder. In the engine, air is compressed on the upstroke by absorbing energy from the flywheel. Oil is forced into the cylinder and burned under practically constant pressure conditions. On the downstroke, the hot gas expands and delivers more work to the flywheel than was absorbed in compressing the charge. Work required for the compression stroke is a large fraction, around two-thirds, of the work of the power stroke.

All these operations are duplicated in the gas-turbine unit, except that the flow is continuous. The total heat-temperature-entropy chart of Fig. 5 could apply to either turbine or diesel engine. For the gas turbine, compressing 1 lb. of air from atmospheric pressure and 60 deg. F. to 60 lb. per sq.in. gage and approximately 420 deg. F. requires 87 B.t.u. in the form of mechanical work at 85 percent compressor efficiency. Burning oil raises the temperature to 1,200 deg. F. at the expense of 193 B.t.u. In expanding through the turbine at 88 percent efficiency, 130 B.t.u. of useful mechanical work can be realized with actual blades. The exhaust gas carries away 150 B.t.u. at about 700 deg. F., part of which can, of course, be reclaimed in a

Fig. 3—Basic gas-turbine assembly includes a multi-stage compressor, combustion chamber, small starting motor and the power-producing gas turbine



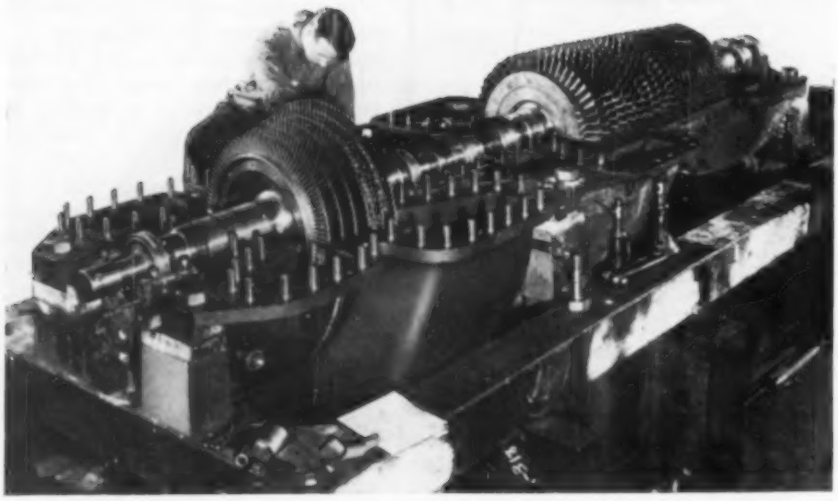


Fig. 4—Allis-Chalmers gas-turbine, axial-compressor unit for a Houdry plant, rated at 23,000 c.f.m. of air at 45 lb. ga. pressure

heat exchanger or waste-heat boiler. In all, the unit can put out 130 minus 87 or 43 B.t.u. per pound of air flowing, at the expense of 193 B.t.u. from fuel oil, or approximately 22.3 percent thermal efficiency.

This efficiency, for the basic cycle, compares poorly with perhaps 30 percent for steam power plants and around 40 percent for the best diesel engines. As presently constructed, gas-turbine units are limited to 1,200 deg. F. operating temperature and a compression ratio of around four, instead of perhaps 30 for diesel practice.

Only one unit has been built to date designed solely for power generation. This 4,000-kw. single-shaft machine is installed in an underground tunnel at Neuchatel, Switzerland, for standby service. Because it was expected to run only infrequently, efficiency was not a prime consideration. On test it developed 4,180 kw. net power (4,040 kw. at the generator terminals) from 15,660 gross turbine kilowatts, 11,480 kw. being used by the compressor. Thermal efficiency was reported as 17.38 percent at the coupling, corresponding to a heat rate of 19,600 B.t.u. per kw.-hr. and a fuel rate of 1.08 lb. of fuel oil per kw.-hr. Temperature at the gas-turbine inlet on test was 1,025 deg. F.

The apparent handicap in efficiency compared with steam and diesel practice is at least partly balanced by simplicity of construction as compared to the former and ability to burn bunker oil instead of the premium fuel required by the latter. Moreover, accumulated experience and improved shop practices indicate that the efficiency of the Neuchatel type could be raised to about 21 percent for operation at 1,000 deg. F., while with 1,200 deg. F. definitely in sight and within reach when war conditions permit, the efficiency of this simplest machine reaches 25 percent. At 1,500 deg. F., which is still in the future as far as materials are concerned, this basic unit could deliver power to the coupling at 28.5 percent thermal efficiency.

Even with present materials, that is, at 1,200 deg. F. temperature, the efficiency can be increased 3–4 percent by adding a heat exchanger of reasonable size, corresponding to the air preheater or economizer of a steam plant. By an intercooler between stages of the air compressor and a two-shaft, two-stage arrangement, another 2–3 percent may be had.

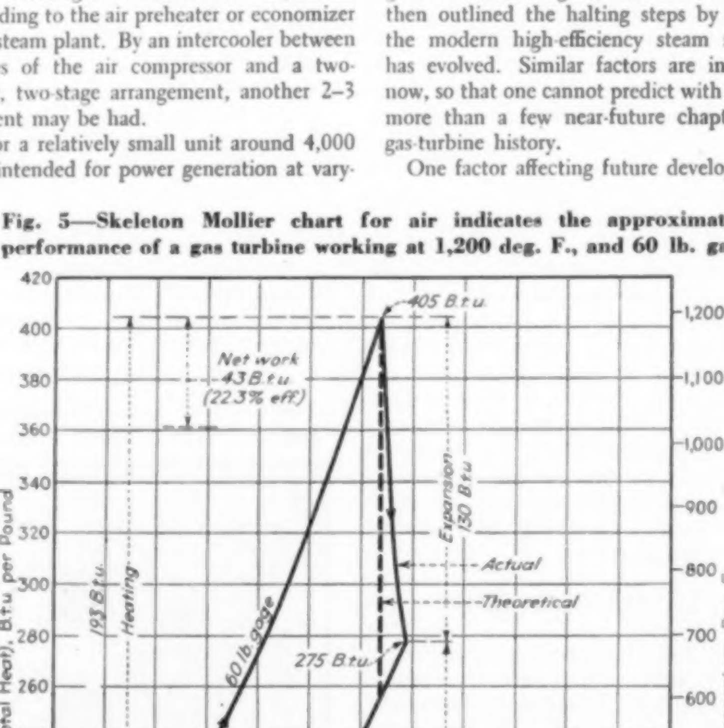
For a relatively small unit around 4,000 kw. intended for power generation at varying load, there would be two gas turbines supplied by a single combustion chamber, one driving the compressor at variable speed to suit load conditions, and another driving the generator at constant speed. For 8,000 kw. or larger, it would probably be desirable to go to two pressure stages (120 lb. gage) and add a reheater combustion chamber between turbines as well as one stage of intercooling.

Brown, Boveri states that such a unit, in 4,000–10,000-kw. size, built for 1,200 deg. F. at 60 lb. gage pressure, would have an over-all heat rate approaching 12,000 B.t.u. per net kw.-hr. (28.5 percent over-all thermal efficiency) and could be delivered and installed in the United States for a cost of around $50 per kw. including auxiliaries and generator switchboard. The machine could burn any grade of fuel oil or gas, but for gas fuel an additional small compressor would be required.

Much discussion has been occasioned by the simple factual statement that it is possible for the efficiency of gas turbines to approach or even exceed that of diesel engines. Fifty years ago the same could have been said of steam turbines as regards the steam engine, but few could have then outlined the halting steps by which the modern high-efficiency steam station has evolved. Similar factors are involved now, so that one cannot predict with clarity more than a few near-future chapters of gas-turbine history.

One factor affecting future development

Fig. 5—Skeleton Mollier chart for air indicates the approximate performance of a gas turbine working at 1,200 deg. F., and 60 lb. ga.



stands out above all others. Like the steam turbine, the gas turbine is inherently a large-power device. At present the smallest size of power unit for even reasonable efficiency might be set somewhere around 2,000 hp. Since few diesel engines over this size are found in stationary plants, competition between the two prime movers would seem limited to the marine and railroad field.

Waiting only on release of critical materials is the gas-turbine locomotive, already a reality in Switzerland. Allis-Chalmers designs call for two gas-turbine units to deliver about 5,000 hp. to the drivers of an 87-ft. locomotive, as compared to the two 100-ft. elements of the Union Pacific steam-turbine-electric experimental type or the three- or four-unit articulated diesel propulsion of the streamliners. Gas-turbine drive would have an efficiency of 17 percent or more as compared with 12–14 percent for steam turbine drive and 6–8 percent for standard reciprocating steam engines. They would, however, not equal the 23–25 percent performance of diesel locomotives but would have the advantage of containing equal power in a single car (plus fuel tender), would require no water and would fire bunker oil of considerably less cost than diesel fuel.

A "natural" application of gas-turbine drive, already contracted for by the Maritime Commission, will be for merchant-ship propulsion. The first such unit, obviously for experimental purposes, will drive a 7,200-ton coastwise freighter of the C1-M-AV1 type. The drive unit, to be built by Elliott Co., will develop between 2,000 and 3,000 hp. Designs have been presented by others indicating that a 4,000-hp. gas turbine would occupy no more space in a 10,000-ton Liberty ship than its present conventional 2,500-hp. steam engine plant and give substantially more speed.

Many stubborn details remain for marine engineers to work out, but a power plant weight of around 20 lb. per hp. and a space occupancy of about 3 cu.ft. per hp. for the gas turbine itself (to which must be added weight and space for reduction-gear and reversing equipment) offer a powerful incentive, plus the probability of fuel consumption below 0.7 lb. per hp., comparable with best modern steam-turbine drive.

Another factor affecting the future development of gas turbines for power and process use is the war-fostered airplane supercharger. The single-stage gas-turbine, centrifugal-compressor combination known as the turbo-supercharger first operated commercially in 1923 on a 500-hp. diesel engine. Even before the war, supercharging stationary and marine diesel engines had become a recognized means of increasing the power output of a given internal combustion engine cylinder.

The turbo-supercharger is not expected to produce mechanical power beyond that

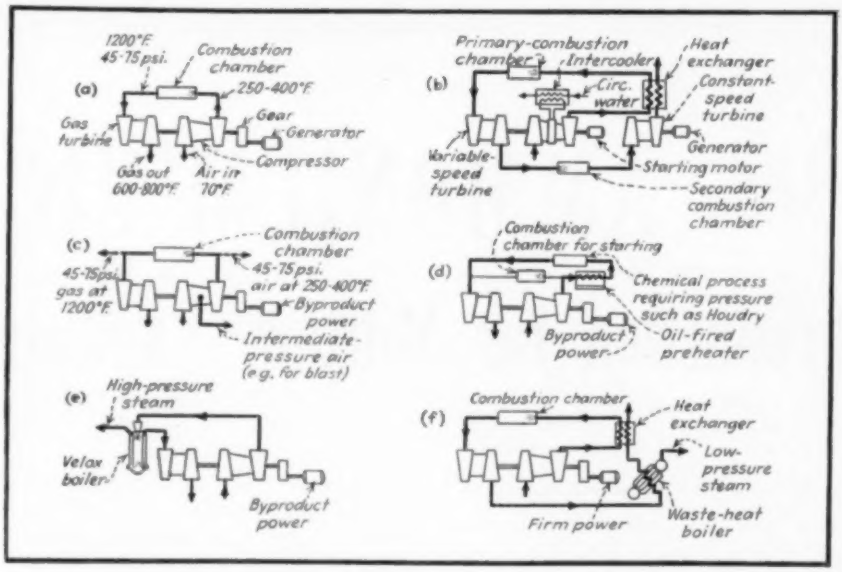


Fig. 6—Gas turbines offer the most versatile heat-balance arrangements of any prime mover: (*a*) Basic power unit requires no cooling water or auxiliary apparatus (*b*) Two-stage power unit approaches best steam plant efficiency if provided with heat exchanger and intercooler (*c*) Useful output can be taken as compressed air at any pressure up to about 75 lb. ga. (*d*) Some 35 of these process units are helping make aviation gasoline (*e*) First practical application of the gas-turbine combination was as an auxiliary to the high-pressure Velox boiler (*f*) Byproduct steam from waste-heat boilers can be had in limited quantities

required to drive its own compressor. Invariably associated with a reciprocating engine, the turbo-supercharger interposes a single-stage turbine wheel between the engine exhaust manifold and the atmosphere. In the most common form, this wheel drives a single-stage centrifugal blower at speeds up to 30,000 r.p.m. to produce a pressure above that of the surrounding atmosphere in the intake manifold of the engine.

Because supercharging induces a greater weight of air to enter the cylinder on each stroke, a greater weight of fuel can be burned and maximum horsepower is increased. Efficiency of the turbine and compressor are such that an intake manifold pressure greater than the corresponding exhaust manifold pressure is easily obtained.

Superchargers for diesel engines normally operate at exhaust gas temperatures below 1,100 deg. F. More recent airplane gasoline engine types must sustain temperatures of 1,800 deg. F. and above. It is from development of high temperature materials for the latter service, now veiled by wartime censorship, that power type gas turbines can hope for alloys to stand temperatures above 1,200 deg. F.

Applications in the stationary power field can be outlined only vaguely. For the immediate future at least, size range will be restricted to a minimum of 2,000 kw. and a maximum of 10,000 kw. While experiments with burning pulverized fuel were undertaken some time ago on a 1,500-kw. unit in Switzerland, no information is yet available in this country as to the results. It is to be expected that considerable time must elapse before satisfactory performance can be surely predicted with solid fuels.

It would seem that the versatility of the gas-turbine unit would make it eventually more important in process work than in straight power generation. Briefly stated, the continuous-combustion unit can produce either high- or low-pressure steam, compressed air and power in any proportions desired. Possibilities can best be illustrated by the six schematic sketches of Fig. 6.

A conventional unit, Sketch (*a*), represents the arrangement of the only machine thus far built for power alone, the 4,000-kw. standby plant at Neuchatel. Sketch (*b*) indicates typical refinements in heat balance that can lower the heat to about 12,000 B.t.u. per kw.-hr.

Sketch (*c*) indicates the manner of air takeoff at any pressure up to about 75 lb. per sq.in. for a single-shaft machine. By compounding, pressures up to 120 lb. are available. High temperature gas can be had after the combustion chamber, or air free of combustion gas can be obtained by addition of a heat exchanger. This set-up is typical of the blast-blower previously mentioned, which takes intermediate pressure air for the blast and high pressure air for combustion. Sketch (*d*) represents the present application for the Houdry process.

Sketch (*e*) diagrams the Velox boiler. The present form of gas-turbine, axial-compressor set was originally developed as an auxiliary to this boiler which depends

(*Continued on page 108*)

T. C. GERBER * *Col., Ordnance Department, U. S. Army*

AMMONIUM PICRATE

Production for Military Explosive Requirements

In World War I, ammonium picrate was the secret high explosive of the United States and was known as Explosive D in order to avoid common knowledge of its chemical composition. The present program for this product was started in 1940 as an Ordnance-Industry project and has involved erection of new buildings, installation of machinery and equipment, and training of operators. Two methods are being used for the production of this important explosive; one starting with phenol as the raw material, and the other starting with dinitrochlorobenzene. It is the latter process which is described in this article.—*Editors.*

From the standpoint of explosive strength alone, ammonium picrate is inferior to TNT, but, nevertheless, is still important as a military explosive because of its marked insensitiveness to shock and friction. It is this latter property which makes it well suited for use as a bursting charge in armor piercing shells, in projectiles for seacoast cannon and in other types of projectiles which must withstand severe shocks and stresses before detonating. Like TNT and picric acid, ammonium picrate liberates free carbon on explosion, giving a black smoke. The products of the explosion, although more disagreeable in odor, are less poisonous than those from TNT and picric acid, in that they contain less carbon monoxide.

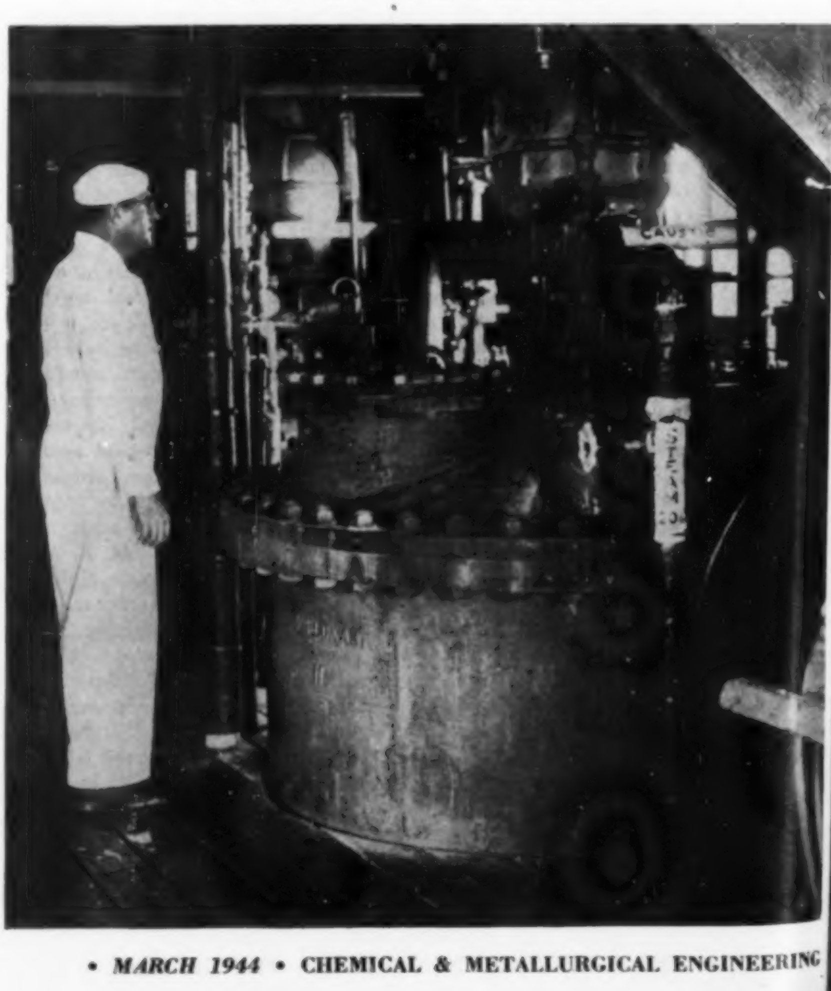
Ammonium picrate is a powder of light yellow color which will not melt on heating, but if raised to a temperature of 300 deg. C. will decompose with explosive violence. Loading is therefore accomplished by pressing or tamping the powder into the projectile.

There is only a slight tendency for ammonium picrate to absorb moisture, but if it does become wet, it can form sensitive and dangerous picrates with copper and lead. No explosive compounds are formed with steel, but in order to avoid corrosion, the interior of the shell is coated with a suitable non-metallic paint or varnish before it is filled, and a moisture-proof seal is provided at the base of the projectile.

THE PROCESS

To summarize the process used by some of the government-owned, contractor-operated facilities program, dinitrochlorobenzene (DNCB) is hydrolized with a hot aqueous solution of caustic soda, the resultant sodium salt of dinitrophenol (DNP) is precipitated by sulphuric acid,

In a cast iron kettle similar to the one shown in this illustration, dinitrochlorobenzene is hydrolyzed with a hot aqueous solution of caustic soda. The resultant sodium salt of dinitrophenol is then precipitated by sulphuric acid, filtered and sent to the nitrators



* Colonel Gerber is Field Director of ammunition plants and recently was appointed Director of Safety, and Chief of the Ordnance Department's Safety and Security Branch.

Raw Materials Required in DNCB Process for Ammonium Picrate

Process Step	Material	Pounds Per Batch ("as is" basis)	Pounds Per Batch (100% basis)
Hydrolysis	DNCB	1153	1153
	Caustic Soda (50% Soln.)	968	484
Neutralization	Surphuric Acid (97%)	340	330
Nitration	Sulphuric Acid (97%)	3960–5040	3840–4890
	Mixed Acid (70:25:5)	596	417 (HNO_3)
Ammoniation	Aqua Ammonia	362	94

and the DNP itself isolated as a wet filter cake. This filter cake is slurried with strong sulphuric acid and nitrated to picric acid (TNP) by means of mixed acids. The TNP is filtered, neutralized with aqua ammonia in hot aqueous solution and crystallized as ammonium picrate (AP) which is filtered and dried.

RAW MATERIALS

Standardized equipment for the manufacture of ammonium picrate by the DNCB process accommodates a batch size which is equivalent to 1,250 lb. of ammonium picrate, provided optimum process yields are obtained. Raw material requirements for this size batch are indicated in the table above.

HYDROLYSIS OF DNCB

This step in the process is carried out by charging water, caustic soda solution and molten DNCB to an agitated cast iron kettle. After closing the kettle and venting it, steam jets are used to heat the contents to 70 deg. C., the heat of reaction taking the temperature up to 100 deg. C. without further use of steam. On slackening of the reaction rate, the entire batch is boiled for about one-half hour after which it should still be alkaline to phenolphthalein.

While the kettle batch is in progress, a wooden vat is charged with 5,600 lb. of water and 340 lb. of 97 percent sulphuric acid, the mixture then being agitated and heated to 75 deg. C. with open steam. The completed hydrolysis batch is then blown by steam pressure through a preheated transfer line to the vat, where the final mixture must test acid to Congo red paper. Sudden drowning of hydrolyzed DNCB in sulphuric acid results in a fine precipitate of DNP which must be digested and converted to the form of coarse granular crystals.

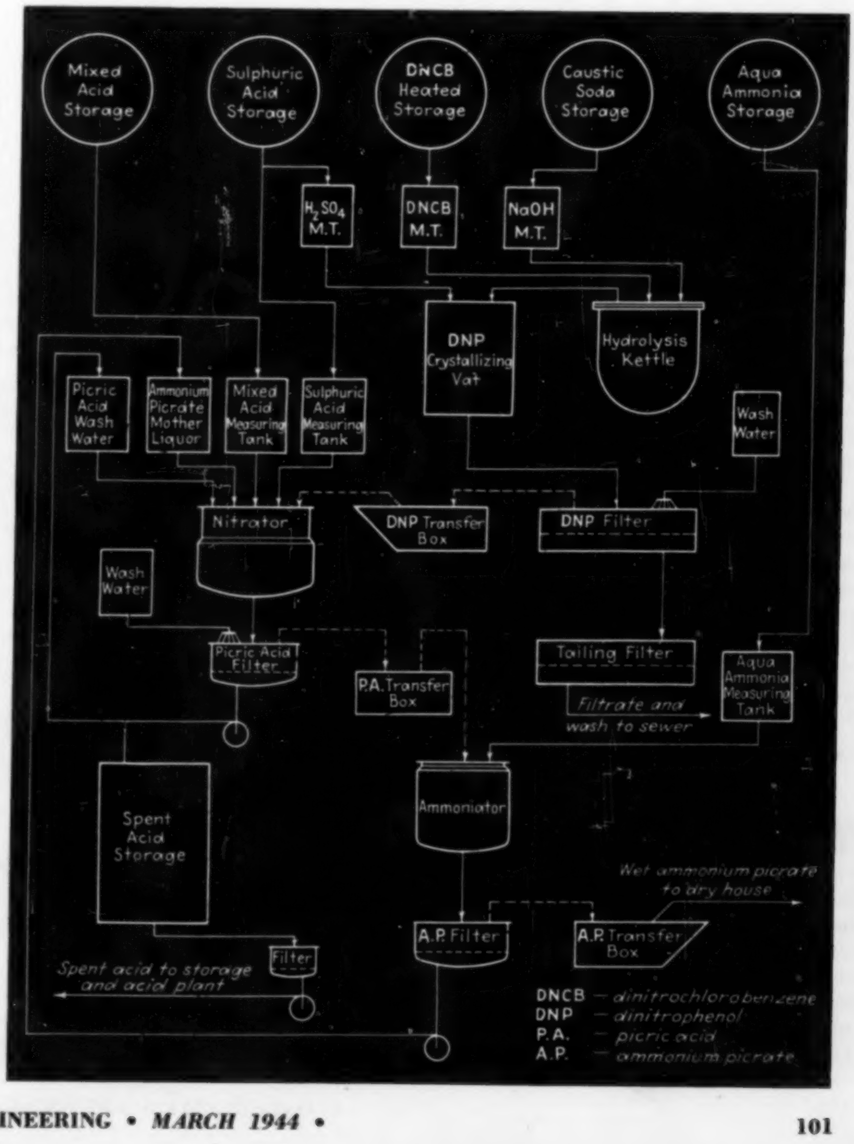
Atmospheric cooling aided by agitation lowers the temperature of the slurry to 80 deg. C., further lowering of the temperature down to 40 deg. C. being accomplished through use of cooling water in the coils. DNP Crystals are then separated from the mother liquor by filtration on a wood vacuum filter and washed with water to remove excess chloride. The moist filter cake is heated to 90 deg. C. and again dried as much as possible by application of vacuum. After as much moisture has been evaporated as possible, the DNP filter cake is lowered into boxes for temporary storage and subsequent transfer to nitrators. Analysis of the DNP for strength must reveal a melting point of 111 deg. C. or higher.

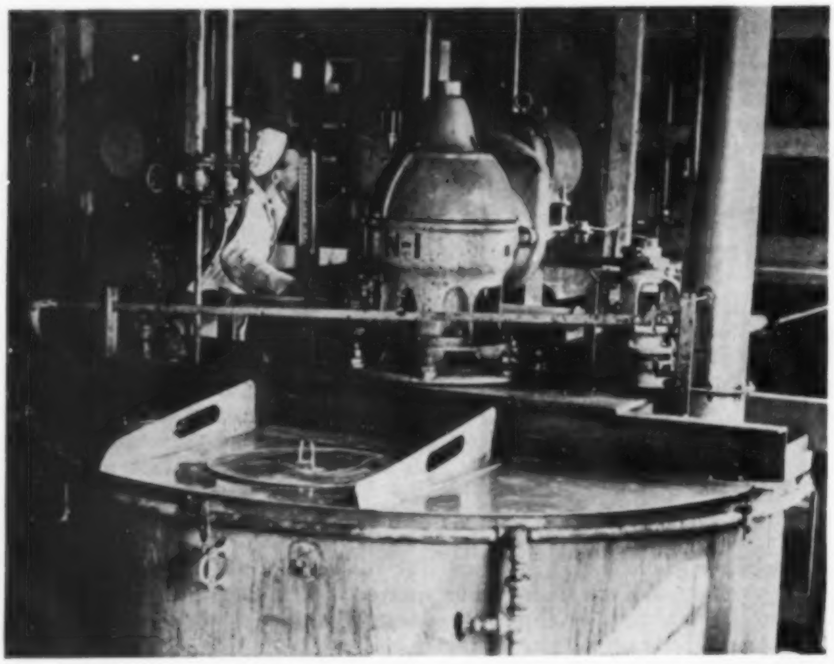
NITRATION OF DNP

Each batch of DNP is nitrated individually to form one batch of TNP. Prior to nitration, the DNP is slurried with sufficient sulphuric acid to give a fluid suspension of whatever solids are present at the temperature prevailing during nitration. The acid must also be adequate in quantity to take up both the residual moisture in the DNP and the water produced by nitration without becoming weaker than 91 percent. For DNP batches which are above 87 percent in strength, the minimum quantity of 97 percent sulphuric acid which can be employed is 3,960 lb. For batches which are below 87 percent in strength, an additional 210 lb. of 97-percent sulphuric acid must be charged for each percent by which the DNP strength is below 87 percent. DNP below 82 percent in strength requires special handling.

Nitration is accomplished in a jacketed nitrator. One batch from the DNP filter (approximately 1,015 lb. on 100 percent basis) is shoveled into the nitrator through a hopper with screen bottom to provide for crushing all lumps. The temperature is then adjusted to between 35 deg. and 45 deg. C. by admitting steam or cold water as required. Mixed acid containing 70 percent HNO_3, 25 percent H_2SO_4 and 5 percent H_2O is fed to the nitrator over a period of about 1½ hr. allowing the batch

This diagrammatic flowsheet indicates the various processing operations required in the manufacture of ammonium picrate





Filtered dinitrophenol is slurried with strong sulphuric acid and nitrated with mixed acid (70:25:5) in jacketed nitrators like this one. The dinitrophenol is fed through a hopper with screen bottom to insure that all lumps are crushed, thus aiding formation of a fluid suspension

temperature to rise slowly, so that at the end of the acid feed the temperature will reach approximately 95 deg. C. For 30 minutes the batch is held at 95 deg. C. and agitated, then cooled to 80 deg. C. and diluted with 2,400 lb. of previously produced ammonium picrate mother liquor. This dilution must be done carefully to avoid excessive foaming which results from too vigorous an evolution of nitrogen oxide.

The batch dilution is continued using picric acid wash water from previous batches until a total of 6,500 lb. of water has been added as diluent. During dilution, the batch temperature must not be allowed to exceed 100 deg. C. nor drop below 65 deg. C.

After dilution, the batch is cooled to 35 deg. C. and filtered, the acid filtrate being sent to spent acid storage, and the filter cake washed and dried by application of vacuum for about one hour. The batch production of picric acid is approximately 1,212 lb. of 100 percent material. Acceptable TNP has a melting point of 121 deg. C., or above, and contains no more than 0.5 percent sulphate as H_2SO_4.

AMMONIATION OF PICRIC ACID

Two and one-half nitrator batches (the equivalent of 3,125 lb. of AP) are combined to make one ammoniation. Before charging this material, approximately 3,600 lb. of fresh water are added to the ammoniator and heated to 100 deg. C. with jacket steam. Air agitation is then begun and the two and one-half batches of picric acid filter cake plus aqua ammonia are added to the ammoniator over a period of 1½ hr. in such a manner that the batch remains slightly alkaline to brom thymol blue test paper at all times. The batch is maintained at 100 deg. C. throughout the operation and great care is necessary to insure that all picric acid is in solution when the final adjustment for neutrality is made.

A period of 12 hours is required to cool the batch to 40 deg. C., using automatic controllers to regulate the temperature of the jacket cooling water by external means in accordance with a planned rate-of-cooling curve. It is essential to supply good agitation with the air agitator throughout the cooling cycle. When the ammoniator batch has reached the temperature of 40 deg. C., it is filtered, washed with mother liquor, dried by application of vacuum for two hours and loaded into boxes for temporary storage and transfer to the dryer house. In each line the entire 24-hour production of wet ammonium picrate is transferred to the line dry-house on day shifts, and divided between three dryer tubs. The contents of these tubs are dried by passage of forced-draft air preheated to a temperature of 70 deg. C. When dry, the ammonium picrate is unloaded into a hopper, screened to remove material too coarse to pass specifications, and packed in the prescribed container.

SULPHURIC ACID RECOVERY

The spent acid used to liberate DNP from hydrolized DNCB is transferred to sulphuric acid concentration units where it is concentrated to approximately 96 percent strength. This 96-percent concentrated sulphuric acid is then mixed with sufficient purchased 20-percent oleum to produce 97-percent sulphuric acid for re-use in the process. It has been found that about 500 lb. of 20-percent oleum must be purchased per 1000 lb. of AP in order to compensate for the sulphuric acid consumed in the DNP process and off-set all sulphuric acid handling and concentration losses.

Trinitrophenol (picric acid) formed in the nitrators is filtered and washed in vacuum filters. When thoroughly washed and dried, the picric acid is slurried with water and ammoniated with aqua ammonia

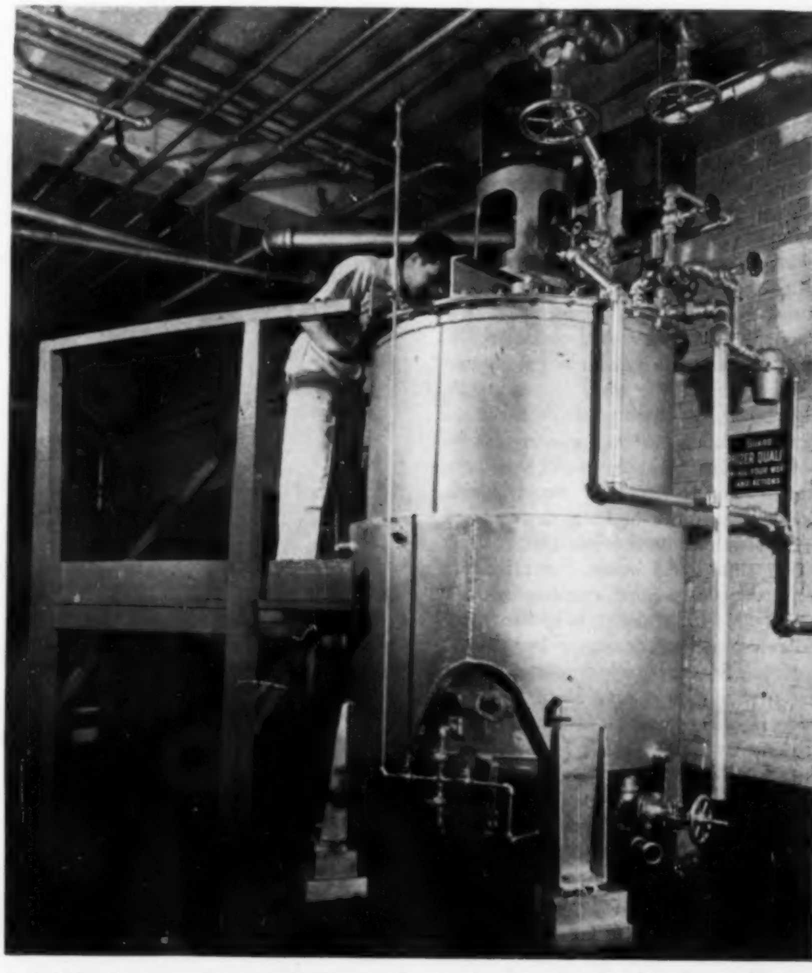
ALBERT L. ELDER AND LAWRENCE A. MONROE

Respectively, Chemicals Bureau and Office of Production Research and Development, WPB

PENICILLIN

Wartime Growing Pains of the Industry

From a "seed" in 1942 to an industry of 20 plants valued at $20,000,000 is the record of penicillin. In early stages it was made in milk bottles, but new processes require vessels of capacities up to several thousand gallons, and other large-scale chemical engineering equipment. As improvements raise output penicillin may be expected in adequate quantities for all essential uses. However, companies are working desperately to synthesize the materials although as a result barely completed fermentation plants may become obsolete.—*Editors*



A deep fermentation tank for production of penicillin by the so-called submerged fermentation process, one of three processes in use at present

PENICILLIN is produced by the mold *Penicillium notatum*. Prof. Alexander Fleming at St. Mary's Hospital, London, first noted that staphylococcus colonies contaminated with mold failed to grow, and deduced that the staphylococcus was inhibited by some material produced by the fungus. In 1929 Fleming published results showing that filtered mold broth contained an antibacterial substance affecting any gram-positive organism. Ten years elapsed before any appreciable impetus was given to this work. Chain and Florey of Oxford reported results confirming Fleming's early work and isolated the impure active principle as a brown water-soluble substance. With sufficient purification this brown substance could be injected into the body without toxic effects.

Through the cooperation of the British, full information regarding the status of penicillin was transmitted to this country in 1941 and 1942, and laboratory work was started in the United States. Only experimental quantities were produced in 1942, and very little during the first half of 1943. Process developments and clinical results during the first months of last year were sufficient to warrant consideration of large scale production and the approval of construction of 18 plants in the United States and two in Canada. These plants are:

Abbott Laboratories, North Chicago, Ill.
Allied Molasses Co., Brooklyn, N. Y.
Ben Venue Laboratories, Bedford, Ohio
Cheplin Biological Labs., Syracuse, N. Y.
Commercial Solvents Corp., Terre Haute, Ind.
Connaught Laboratories, Toronto, Canada
Cutter Laboratories, Berkeley, Calif.
Heyden Chemical Corp., Garfield, N. J.
L. F. Lambert Co., Coatesville, Penn.
Lederle Laboratories, Pearl River, N. Y.
Eli Lilly and Co., Indianapolis, Ind.
Merck and Co., Inc., Rahway, N. J.
Parke, Davis and Co., Detroit, Mich.

The editors wish to thank Chas. Pfizer & Co. for use of these pictures.

Chas. Pfizer and Co., Brooklyn, N. Y.
Reichel Laboratories, West Chester, Penn.
Schenley Research Institute, Lawrenceburg, Ind.
E. R. Squibb and Sons, New Brunswick, N. J.
Upjohn Co., Kalamazoo, Mich.
Winthrop Chemical Co., Rensselaer, N. Y.
Ayerst McKenna & Harrison, Montreal

This construction program, rushed through on high priority rating, was 90 percent complete on Mar. 1. The critical materials required for process equipment have been extremely difficult to obtain and in some instances it will be mid-year before all of the finishing equipment is installed. The British production is at present only a fraction of that of the United States, and their proposed expansion program, because of lack of critical materials and manpower, is also comparatively small.

The publicity given to the penicillin program and the uses of the drug have been perhaps greater than is warranted by the clinical results obtained thus far. It is far from being a "cure-all" drug and has the additional disadvantage that no successful procedure is known for its oral administration at this time. Many types of organisms are unaffected by penicillin, and hence disease caused by such organisms cannot be treated with this drug.

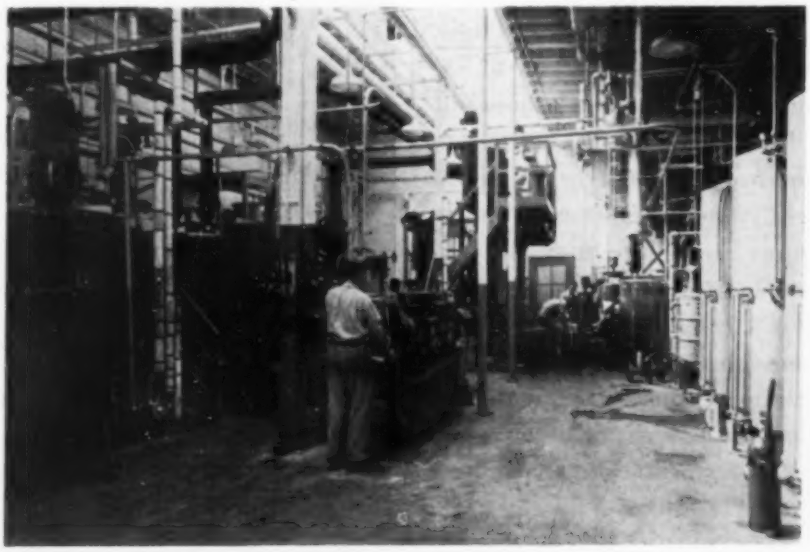
Penicillin may be applied to surface infections, or administered intravenously and intramuscularly. The drug is particularly effective against gram-positive organisms although gonococcus and meningococcus are affected. Remarkable results have been attained against hemolytic streptococcus, pneumococcus, and staphylococcus aureus. As new uses have been found for penicillin through clinical researches, the ceiling to which production must rise has continuously lifted. Uncertainties as to the course of the war are, of course, a key to this situation. Almost equally important, however, in this picture, may be the addition of one after another to the list of human disabilities which may be treated with penicillin.

It is made by three principal processes: surface fermentation in shallow vessels such as bottles; submerged fermentation in vessels of capacities up to several thousands of gallons; and fermentation by the mold *penicillium notatum* growing on moist bran held in large containers and trays. The earliest-developed surface fermentation has until recently been the mainstay of the limited production. Within recent weeks, however, the success of the submerged and bran processes has been clearly demonstrated on large scale with attendant economies of manpower and cost. While many improvements remain to be made, successful operation of commercial submerged and bran fermentors proves now that these units can and will continue to supply about three-fourths of our penicillin. As new plants come into production and as process improvements raise the output of existing plants perhaps several-fold, penicillin may assuredly be expected in adequate quantities for all essential uses that this drug can supply.

The development has suffered all the difficulties of construction materials, manpower, and raw materials shortages that beset other wartime developments. It has been further complicated in that plant construction was started while the process was still under development in laboratory and pilot plant. Many persons have learned that a mold fermentation does not always follow the chemical and engineering generalizations that have formed the groundwork of the commercialization of chemical processes. Since every unit of penicillin that has been produced to date has been needed for medical use, the initiation of the study of every processing improvement has necessarily been preceded by a careful balance of the benefits to be gained in increased production, if the study proved successful, against the temporary diversion of production to experimental use while the study was under way. Pressure to supply a material whose value is calculated in terms of human lives weighs heavily in such considerations and has necessarily led to the conduct of a maximum amount of experimentation on processing methods in the laboratory on small scale. Any engineer recognizes the requirement of high skill necessary to transfer results of such investigation directly into the plant.

Although it has been established that the fundamentals of contemplated penicillin production methods are sound, there remains a host of problems to be solved. First is the problem of bringing all plants to full production rate. Second are those of increasing plant capacities through technological improvement to enable future increases in penicillin requirements to be met through modification of present plants so far as possible, rather than through the slower and more wasteful process of constructing new plants. Third, but perhaps most important, is the necessity to improve the quality of the product with regard to its chemical stability in order that in the future penicillin may be shipped and stored under adverse conditions without danger of deterioration.

Effort on a nation-wide scale is being applied to the solution of the above and related problems. The development in this country was planted and carefully tended throughout its early life by the Fermentation Division of the Northern Regional Research Laboratory of the U. S. Department of Agriculture, under the leadership of Dr. Robert D. Coghill. The work of this group, allied with the Committee on Medical Research of the Office of Scientific Research and Development, continues in its far-reaching influence over the entire field of penicillin in this country and abroad. Other groups brought together by the Office of Production Research and Development are also contributing technologically to the industry in the period of plant construction and conversion of processes to large scale. These include biochemists, bacteriologists, and botanists concerned with fermentation problems and working under Dr. W. H. Peterson at the University of Wisconsin; chemists, bacteriologists, and chemical engineers at the Pennsylvania State College headed by Dean F. C. Whitmore on developing processes for the recovery of penicillin from the fermentation broth; chemical engineers headed by Dr. T. K. Sherwood at the Massachusetts Institute of Technology studying and advising on methods of drying the final product for



Principal processes are: surface fermentation in shallow vessels, submerged fermentation in large deep vessels, and fermentation on bran

packaging and shipment; and plant pathologists led by Dr. E. C. Stakman at the University of Minnesota and Dr. G. W. Beadle at Stamford University in search for better mold strains. Intensive effort by corn products industry is being devoted to improvement of nutrient factors for the growth medium.

Synthesis of penicillin is under the control and direction of the Office of Scientific Research and Development. Companies are working desperately to synthesize the material even though it may make obsolete fermentation plants barely completed. Those familiar with the trials and tribulations of research work know how optimism and pessimism fluctuate day by day. As of the time of writing, success may come today, tomorrow, or never.

The construction, allocation, and program coordination of penicillin by fermentation methods has been in the Chemicals duction of adequate supplies of penicillin. Efforts of the technical research and development groups are closely coordinated to avoid overlapping in their complicated pattern of interrelationships. Their results are transmitted on restricted basis to WPB and to the scientists and engineers of the penicillin manufacturers approved by WPB, who, being on the actual firing line of production, carry directly the responsibility for our present and future supply of penicillin, as well as to other governmental and research groups. The untiring effort of the staffs of the 20 companies in the United States and Canada which are producing or preparing to produce penicillin are the direct basis for present and future production. The performance of these men have been equaled by and coordinated with the effort of the manufacturers of equipment and the suppliers of raw materials to the penicillin industry. The compound. The concentration in the broth at harvest is in the same order of concentration as bromine in sea water; however, penicillin separation and recovery is far more complicated. Standards of purity and methods of testing for toxicity and pyrogens are closely coordinated by Food and Drug Administration.

The raw material requirements for the production of a few pounds per month of finished product are staggering, and it is in this field that great progress may still be made. Search for a new mold strain which might double the production from this $15,000,000 to $20,000,000 plant investment is being rushed forward as rapidly as possible. Seeking a new strain is as tedious as looking for the "needle in the hay-stack" but if found would make possible immediate increase in output which would be measured directly in terms of human lives.

The first penicillin produced in America was made by surface fermentation in shallow vessels such as the flasks shown in this picture

Bureau of the War Production Board. The drug is allocated by the Drugs and Cosmetics Section headed by Fred J. Stock, who is assisted by Roy S. Koch of the Biologicals and Parenteral Solutions Unit.

Civilian requirements for penicillin and clinical research are controlled by Dr. Chester Keefer, of the Evans Memorial Hospital in Boston, under direction of Dr. A. N. Richards, chairman of the Committee on Medical Research of OSRD.

Extraordinarily valuable contributions to the industry come also from the laboratories of the Food and Drug Administration, the National Institute of Health, the Army, the Navy, and other groups too numerous to mention.

Above outlined research is considered essential for the guidance of both governmental groups and industry, regarding both raw material and processing problems on whose solution depends the successful pro- efforts of all of the above groups are needed for many months to come to assure maximum production through attainment of optimum processing mehods.

Newspaper reports from time to time have placed the potential production of penicillin from the existing plants at 200 billion units per month. It is anticipated that this goal will be attained though it is impossible at this moment to estimate with accuracy what these plants will be producing in June when they should be in complete operation. The production has increased about twenty-fold between August, 1943, and February, 1944. In the latter month the output is expected to equal the entire production for the year of 1943. It is expected that the production will increase further between five and ten fold, from March to June, 1944.

Recovery and packaging of penicillin is hampered by the unstable nature of the

Output Climbs

The output of penicillin in the United States during 1943 is estimated by WPB to have been over 21 billion Oxford units. The Oxford unit is the amount of penicillin which completely inhibits the growth of a test organism, *staphylococcus aureus*, under certain specific conditions. Each milligram of penicillin as commercially manufactured contains more than 100 Oxford units. A patient often requires as much as a million units for a series of treatments of a serious infection.

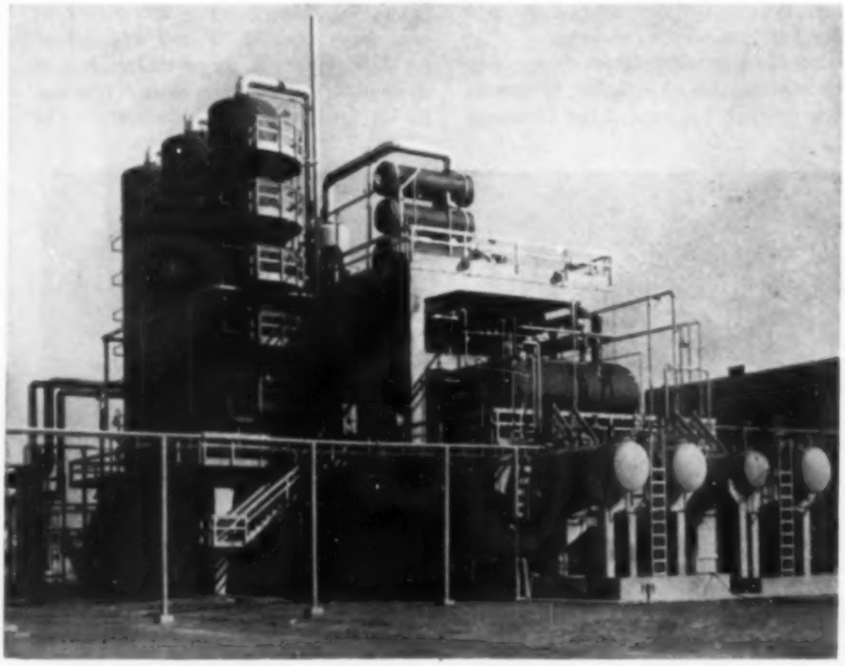
Production in the United States at the new government aided plants has stepped up rapidly; 40 percent of last year's production was made in December alone. Increases are continuing as production capacity goes into operation at the 20 American establishments which will be operating by July. The price of the product last year was $200 per million units. It is now $47.50. Further price reductions are expected this year, despite the difficulty of manufacture through growth of molds.

Manufacture requires critical equipment such as refrigeration machinery, centrifuges, vacuum pumps, tanks, and special packaging devices. The fermentation cycle is unusually long, and exacting conditions of sterility, temperature and atmosphere control are required to obtain any yield whatever. More than 20 quarts of culture fluid are required to yield one gram of the dry powder. Work is still being done to determine the most productive strains of mold and to improve culture media, methods of extraction, purification, standardization and packaging. Chemical research studies are currently being carried on for determining the structure of penicillin, with a view to eventual synthetic production.

C. A. HARWICK *Vice President, The H. K. Ferguson Co., Cleveland*

Postwar Plans for Reconditioning WARTIME STRUCTURES

Certain trends in the housing of the chemical process industries that had become noticeable before the war upset the world will be resumed when peace is once more restored, C. A. Harwick predicts. Other trends naturally are expected to develop as a result of changing conditions. But the buildings that were constructed during the war with a minimum of critical materials need not be discarded as unserviceable if some replacements are made when materials become available. Attention to the "soft spots" will increase the lifetime of a war structure. —*Editors*



Wooden operating platforms around stripping columns and handrails along stairs may be replaced. Firestone synthetic rubber plant, Lake Charles, La.

Don't build yourself up to expect ultramodern plant facilities in the chemical industry as soon as the war is over! The main reason is that you probably will not get them.

A fundamental principle governing well designed industrial buildings is that one of their main purposes is to protect equipment and men from the weather. Following that principle, buildings are only of secondary importance in the chemical industry. Processing equipment is given prime consideration.

Better looking plants, however, can be expected after the war. Their design will be predicated on equipment—not on buildings. Already many chemical manufacturers are studying the example set years ago in the petroleum industry of leaving major equipment out of doors, uncovered, exposed to the weather. They have visited new butadiene, styrene and polymerization plants in the rubber industry and new high-octane plants in the petroleum industry and have marvelled at the appearances gained through effective design treatment of cracking towers, stripping columns and other process units.

The trend is that more and more chemical processes will be put out of doors. Every square foot of covered floor space will have definite utilitarian value. Few new chemical plants of the future will have structures whose value is entirely ornamental.

Two points bear out this statement. First, the chemical industry can well expect a highly competitive market for its products in the postwar period. Ornamental buildings, with no real purpose, are not conducive to the lowest possible unit cost of a product. Second, chemical plants can be made more attractive without benefit of a lot of buildings. These structures usually are designed around equipment; in many instances, they are odd-shaped, grotesque affairs that cannot be tied into any definite pattern. Equipment is interesting regardless of shape, and the fact that it is interesting makes it appealing to the eye.

There is no intention to predict that all chemical plants of the future will be "buildingless." The process will be the governing factor in the future as it has in the past. If equipment can be exposed without damage and without undue hardship on employees, it likely will be placed outside.

Some chemical manufacturers are wondering whether wartime buildings constructed with a minimum of critical materials will be serviceable after the war. The only general answer that can be given is "yes."

In the buildings housing equipment there are certain "check list" items which may be taken care of when materials become available. Attention to them will increase materially the lifetime of a war structure. No good list will omit the possible "soft" spots.

"SOFT SPOTS" IN WARTIME BUILDINGS THAT WILL NEED CHECKING

ROOFS—Often the first source of trouble is the roof. By the time the war is over, if the wartime factory roof has not started leaking, it can be expected to do so soon. War roofs in many cases have been 3 ply, 60 lb. asphalt pitch waterproof composition. It will be advisable to change to 5 ply, 100 lb. asphalt pitch for permanent insurance.

FLASHINGS—Substitutes have varied. None is as satisfactory as copper for general purposes. This work can be done at the same time the new roof is put on.

SIDE WALLS—On some buildings, side walls may be wood sheathing. These should be changed to Transite, masonry or protected metals.

SASH—Chances are the entire plant has wood frame sash made from green lumber which is not satisfactory over a long period. If so, it should be changed to steel sash.

GLASS—As a wartime expedient, cheap, lightweight glass has been used in many instances as substitutes for double-strength or even wire glass and other specialized types. Wartime putty instead of satisfactory glazing compounds or prewar putty also has been used as an expedient and may need attention.

FLOOR—There are several points to check. Was a concrete hardener used in the original floor? Is a stronger slab required in spots than was provided for with limited quantities of reinforced steel? Is it desirable to have a covering of asphalt tile, mastic, or even wood block—none of which has been used usually in "temporary" war plants?

PARTITIONS—In many plants, they are all wood. You will probably want steel, tile, brick or some other fireproof material.

SPRINKLER SYSTEM AND FIRE ALARM—Not all plants have adequate sprinkler systems and fire alarms. They were omitted because of shortages in critical materials. To reduce insurance rates, a plant should have both.

RAILINGS, STAIRWAYS AND OPERATING PLATFORMS—Steel should be used instead of the now prevalent timber.

DOORS—Metal and special fireproof types should be substituted for wood.

VENTILATION—Many ventilator ducts have been built of wood, rather than more dependable sheet metal. Forced-draft systems have been omitted in many plants because of a shortage of blowers, fans and starters.

ELECTRICAL—Much wiring is exposed. It should be placed in conduits to take advantage of lower fire insurance rates and because it affords added protection. Make-shift fixtures should be replaced with standard fixtures. More adequate panel boards, including automatic gear and remote controlled equipment, may be wanted.

SEWERS—Storm and sanitary sewers have been made from vitreous clay tile and lightweight cast iron "victory" pipe. In many cases, standard cast iron pipe should be installed.

TRUSSES—In hundreds of buildings trusses are wood instead of steel. It is not necessary to consider replacing wood trusses and columns. That would be too costly. They should be checked and defective members replaced with sound timber. A great deal of this type replacement is likely in view of the green timber used in war construction. It is probable, too, that plant owners will want to fireproof wood trusses, either through the application of fire-resistant coatings or the addition of Transite coverings, which would serve also as a break against any fire that started in the roof. In this connection, trusses made from green timber usually undergo considerable shrinkage which loosens bolts to the point where they need checking and tightening periodically—otherwise, they may become unsafe.

PIPING—Insulation materials have been of poor grade, thus causing undue temperature losses. Better quality insulation should be installed if needed. Some steel piping possibly should be replaced with copper or brass at an early date.

BOILER HOUSE—Addition of stoker equipment, conversion to oil burners, substitution of turbine-driven for motor-driven equipment and addition of fire-control instruments to provide automatic operation of equipment are a few of the changes which should be studied.

PROCESS EQUIPMENT—This depends entirely upon each individual process. Certainly, there have been some substitutions to save critical materials in every plant. Typical of most of them are manual controls which may be replaced by automatic controls when they become available or the addition of more integrating, recording or metering equipment, probably omitted in the first installation.

In spite of the fact that the chemical industry has expanded to its greatest point in history, engineering and building organizations with special experience in process work can expect a reasonable volume of postwar business. According to studies of the market, there will be four principal sources: (1) consolidation programs around established sites; (2) a few complete plants for production of plastics and other new products and processes now in pilot plants; (3) foreign building to replace facilities destroyed by bombing and to develop new chemical industries in South America and elsewhere, and (4) the usually expected "maintenance" work in the chemical industry with an added program of replacing wartime substitute materials.

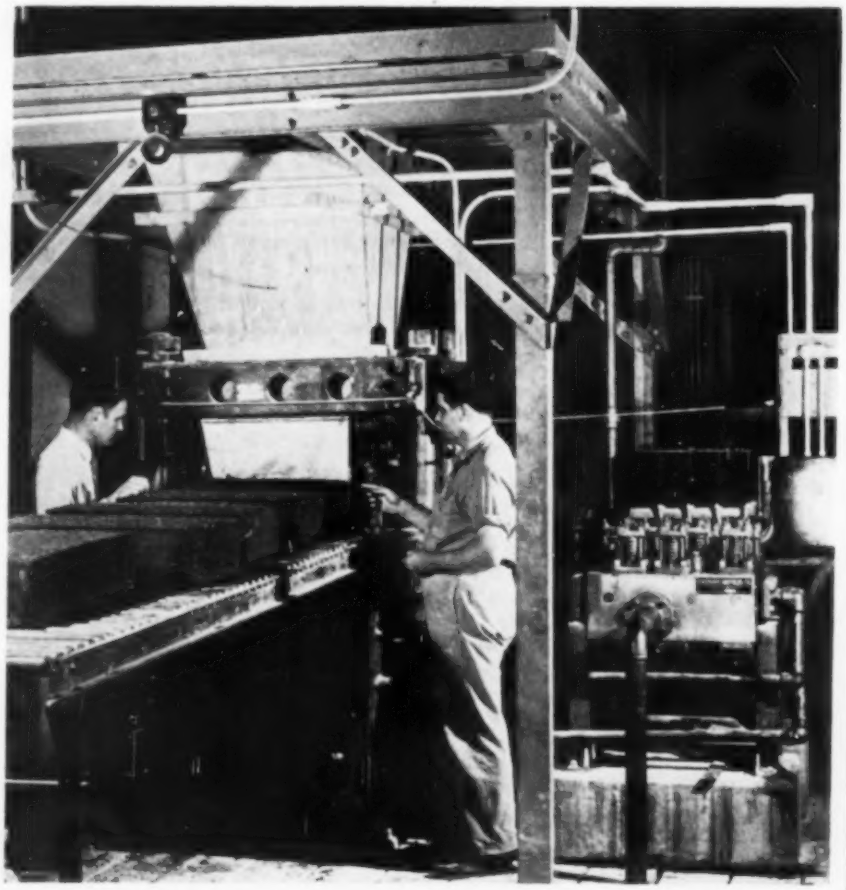
Consolidation programs will affect chemical producers who have been operating plants at widely scattered locations because of the war. This consolidation will represent a good portion of the postwar building program in the chemical industry. Constructing new plants will not be involved to any large extent, rather the addition of new structures at established sites, removal of equipment from one site and erecting it at another, increasing capacities of certain chemicals to fill requirements made necessary through discovery of new products or new processes. At many "old" plants, production techniques will be changed, brought up to date. Piping will be rearranged. Entire plants may even be converted for new materials.

The manufacture of new products likely will result in a few new plants when corporations are ready to introduce their products to the consumer market, but it seems logical that the trend will be toward utilizing, as far as practical, existing facilities. Different manufacturing methods developed by the war and different processes will also serve as a justification for modification of existing facilities—or construction of new facilities.

Foreign countries already have indicated

a desire to establish their own chemical industries. South American nations and countries in the Orient have started detailed investigations. In Europe many chemical plants will be rebuilt. One approach to this demand will be salvaging equipment in some American plants that will be useless to us after the war and shipping it abroad. Entire chemical plants may be dismantled and sent abroad.

The fourth source of postwar work in the chemical field is the usual "backlog" built up year after year in the industry in the form of maintenance construction. Processing equipment depreciates after a time. After that point has been reached, it is cheaper to replace it. Processes also change rapidly. They require adjustments in layout and rearrangements of equipment. Also, the replacement of all the "ersatz" building materials will be a big item in the postwar business cycle for industrial engineers and builders in the chemical field.



Ordinarily this hopper would have been made of steel, but plywood could be obtained more readily. When construction materials become available the management of this synthetic rubber plant of the Copolymer Corp. at Baton Rouge, La., may find it desirable to change to steel

GAS TURBINES

(Continued from page 99)

for its compactness (about one-tenth the space of watertube boilers of conventional construction) on supercharging the combustion space to 20–35 lb. per sq.in. In a sense, the Velox unit represents a gas-turbine application where it is desired to take the entire output of the fuel as high-pressure steam and such small amounts of power as may be incidental to the gas-turbine auxiliary set are purely a welcome byproduct. Some 75 of these steam generators are (subject to correction by the Royal Air Force) in operation in land plants throughout the world.

It will be entirely practicable to utilize only a small amount of steam generating surface around the combustion chamber of the gas turbine to supply any specified quantity of process steam. Additional electric power can be taken from the gas-turbine set, eliminating need for a steam turbine-generator.

Sketch (*f*) indicates the possibilities of waste heat recovery for low-pressure steam, approximately the same as for diesel engine exhaust. Gas leaves the turbine at about 700 deg. F. and any part of its heat may be absorbed in a conventional waste-heat boiler instead of, or in combination with, a heat exchanger.

While the foregoing schematic arrangements indicate that it is mechanically possible to take any desired proportion of net output as steam or power, the process engineer should remember that the gas-turbine combination is inherently a "bottom" as constrasted to the back-pressure steam turbine "top." Where relatively large quantities of moderate- or low-pressure steam are needed for process, and power needs can be generated by a steam turbine working on the difference between boiler pressure and process pressure, the steam plant offers much higher utilization of fuel energy.

In contrast, where relatively small amounts of steam (in comparison to power requirements) are needed at quite high pressure, the steam can be supplied by what amounts to a small steam generating attachment to the gas-turbine combination. Steam making "skims the cream" of the high temperature fuel energy without appreciably affecting the efficiency of the power making function of the gas-turbine unit. In this, as in other ways, the gas-turbine unit shows prospects of becoming a new factor in power service applications by providing an efficient method of "bottoming," just as superposing the back-pressure and extraction types of steam turbine have improved the over-all economy of steam-and-power supply for industrial plants.

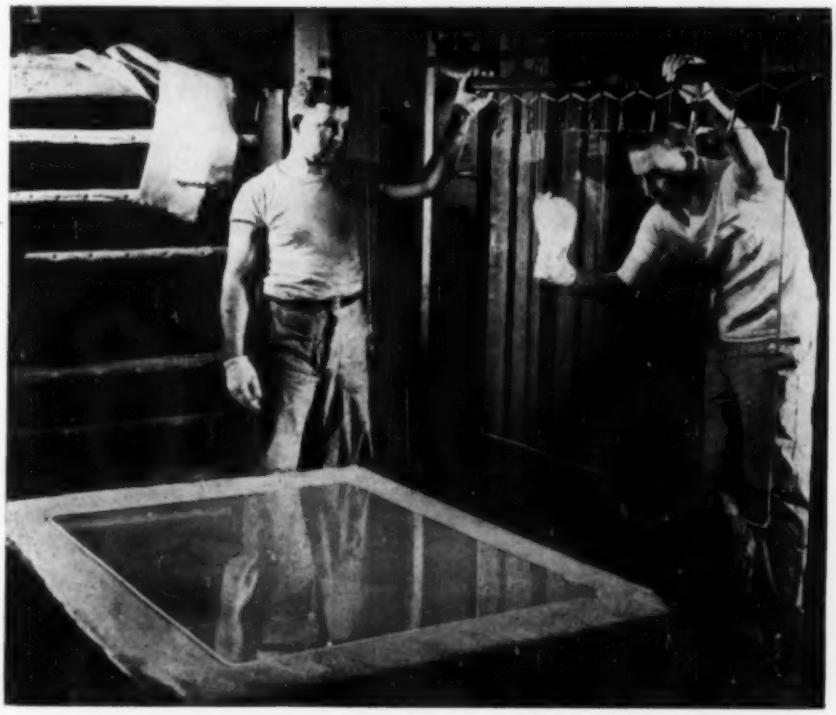
Prediction of future application for gas turbines becames difficult because the gas cycle is only one phase of a rapidly moving age. For example, the conventional gas-turbine unit weighs upwards of 20 lb. per hp. and as such would hardly be expected to compete with the 0.8 lb. per hp. of the gasoline engine for airplane propulsion. Requirements for greater power per engine, however, and possibilities of jet propulsion of ultra-high-speed planes offers a new field for which the gas-turbine combination has no competitor. If high rotating speed and short life of parts can be accepted, gas turbine weight decreases out of all proportion, and the useful work is available immediately to the jet in the form of compressed air.

These are but the elements of possible future gas-turbine cycles. Many combinations and variations are possible, particularly with respect to chemical processes. It will remain for engineers associated with the special problems of individual industries to adapt this versatile new prime mover to their particular requirements. A forward looking observer would conclude that the future of gas turbines depends more on the *differences* between it and other prime movers than on *replacement* of existing machinery that functions reliably and satisfactorily.

J. W. RAYNOLDS *Deputy Director, Chemicals Bureau, War Production Board, Washington, D. C.*

Inter-Relationship of PLASTICS and CHEMICALS

Even the man in the street knows of the brilliant progress that has been made by the plastics industry, but much less is known about its importance as a market for chemicals. As the production of cellulose resins soars to a rate of 135,560,000 lb., and vinyl resins expand from a production of 72,000,000 lb. in 1941 to 212,000,000 projected for the coming year, and others likewise make great strides, so goes the demand for chemical raw materials, styrene, chlorine, phenol, and a host of others. In order to meet these requirements, it has been necessary to construct many new facilities. —*Editors*



Thin liquid methyl methacrylate monomer is transformed into crystal clear practically unbreakable solid

In the first World War the United States did not have a synthetic resin industry worthy of specific recognition. It is true that cellulose acetate dopes and cellulose nitrate plastics were in use at that time. Phenolic resins were known and were struggling for recognition. However, the industry did not play a significant role in the war period, save possibly the contribution of cellulose acetate dopes.

From the end of the World War until 1940 a substantial synthetic resin industry was developed in the United States. This was indeed fortunate, for many of the resins are playing a most important role in the present World War. In fact, had it not been for certain of these resins, we would have had a rather critical military equipment problem resulting from the loss of natural rubber supplies. Other synthetic resins are being used to replace critical metals in the form of plastic parts. In many cases, it has been found that the synthetic resin product served the purpose as well or better than the material for which it was substituted. The story of all the functions of synthetic resins in the war program cannot be told in detail at this time, hence in this paper the emphasis will be on the relationship of the chemicals and the synthetic resin industries.

The Chemicals Bureau of the War Production Board has the responsibility of determining the requirements of chemicals for the war program. In order to arrive at proper figures for the basic chemicals, it is first necessary to determine the requirements in terms of compounded products like plastics, protective coatings, pharmaceuticals, dyes, synthetic rubber, and many other classifications. Once these requirements are known, the specialists in the various branches of the Bureau prepare a breakdown into the many chemical components. When the total basic chemical components are known for the end products, they are added to the requirements for the basic chemicals as such. Each important chemical has been studied in this manner to determine the supply and requirements for the war program. As a result of these individual chemical programs, new production facilities have been planned where and when needed.

The chemical requirements for synthetic resins do not cease with the resins themselves. In addition, there are substantial requirements for chemical plasticizers and organic solvents necessary for the industrial application of the various synthetic resins. Catalysts and pigments augment the chemical requirements but they will not be treated in detail in this paper.

There are a number of groups into which these synthetic resins may be classified. In each group there are several classes, types, and brands. Each resin has achieved a place in the commercial picture because

Homogenized vinyl chloride-acetate plasticized resin in the feed bank of a four-roll calender. Production of vinyl resins has been sharply increased

of one or more properties which render it useful in some industrial application. The principal industrial fields where synthetic resins are employed are: plastics, including film and rubber replacements; protective coatings, including coated fabrics and paints; and printing inks, including lithographic finishes.

The expected demand for plastics and protective coatings for war purposes made it necessary to plan a substantial plant expansion program for synthetic resins and the basic chemical components necessary for their production and use. In spite of this increased capacity, there are times when the military demand for certain resins cannot be met in full. In most cases, the military and essential civilian uses absorb the entire productive capacity, leaving many ordinary civilian uses without material. Since the bottleneck of shortage is now primarily one of basic chemicals, it would require much too long and a disproportionate utilization of critical materials to readily justify further expansion for most synthetic resin purposes.

In order to summarize the expansion which has taken place, each group of resins will be treated separately and the basic chemicals necessary will be indicated. This will be followed by similar treatment for the plasticizers and solvents.

Resins may be classified into two general classes, thermoplastic and thermosetting. There are four major groups of the former type which will be discussed. These are cellulose compounds, vinyl compounds, rubber derivatives, and a miscellaneous group.

The first to be considered are the cellulose compounds used for lacquers, many specialty finishes, and for plastics. Nitrocellulose, cellulose acetate, ethyl cellulose, and cellulose acetate butyrate, are the principal cellulose compounds. Cellophane and vulcanized fiber are important specialties which are not classed as resins in this article. Cellulose is the basic raw material and a variety of chemicals are required to make the final products.

The use of nitrocellulose was severely restricted early in the war because nitric and sulphuric acids, essential for its manufacture, were more urgently needed to make explosives. By the time the acid supply was reasonably available, other resins had become established to meet many military specifications and had demonstrated superior properties for most plastic and many protective coating uses. During late 1943 and projected into 1944, increased military requirements for certain basic chemicals, plasticizers, and solvents, have made it necessary to deny most of these materials for the civilian uses to which nitrocellulose would normally go.

Production of the lacquer and plastic grades of nitrocellulose has increased from 37,000,000 lb. in 1940 to 60,000,000 lb. in 1943. This has accordingly increased the demand for nitric and sulphuric acids which are used in converting cellulose into nitrocellulose. There has, of course, been an attendant increased demand for solvents, such as butyl and ethyl acetate, amyl alcohol, and various chemical plasticizers.

Cellulose acetate uses have increased sharply during this war, increased demands for rayon by the rubber industry and for essential civilian use have been the most significant factors. Unlike the last war, there has been no large demand for acetate dopes for airplane fabric. On the other hand, there have been and will continue to be many military uses for cellulose acetate plastics. Considerable acetate has been available for civilian plastic uses. However, as in the case of nitrocellulose, increased military requirements for the basic chemicals, plasticizers, and solvents, threatens the continued civilian usage of the resin for less essential purposes.

Production of plastic grade cellulose acetate has increased from 24,000,000 lb. in 1940 to 55,000,000 lb. in 1943, with production projected at the same rate for 1944. There have been plant expansions for cellulose acetate flake which has been increased to meet the rayon requirements. In addition, there has been a substantial increase in the production of acetic acid and acetic anhydride, both of which are used to react with cellulose to produce cellulose acetate.

Four principal methods are currently used for producing acetic anhydride. These four processes require or produce the following chemicals in the course of the various reactions: ethly alcohol, isopropyl alcohol, actone, ketene, acetylene, and acetic acid.

Five processes are currently employed to produce acetic acid. The following chemicals are involved in these processes: ethyl alcohol, acetylene, butane, methanol and formaldehyde.

Ethyl cellulose has found a high order of essential war uses. As a result, there is none available for many military purposes and virtually no civilian uses are allowed. This heavy demand was foreseen late in 1942 and limited plant expansion was planned before military requirements became firm. No major plant expansion was authorized because of the requirements for critical metals and the problems involved in going back to produce more ethyl chloride, the chemical which is reacted with cellulose to form ethyl cellulose. Ethyl chloride is made by reacting ethylene or ethyl alcohol with hydrochloric acid under carefully controlled conditions.

Subsequently, ways and means were found whereby the manufacturers could increase their capacity without using critical metals. Changes in other programs made it possible to provide more ethyl chloride so that some increased production will soon be realized.

Cellulose acetate butyrate is currently used in about equal parts for military and civilian purposes. Plastics consume over 60 percent of the production. The continued civilian use of cellulose acetate butyrate for plastics may be difficult to sustain. This is because butyl alcohol is required to make butyric acid which is used, along with acetic acid, in the manufacture of cellulose acetate butyrate. Currently, butyl alcohol is denied to most civilian uses.

Figures on ethyl cellulose are here combined with cellulose acetate butyrate and cellulose acetate propionate. The total production of this group was 8,000,000 lb. in 1941 and had been increased to 32,000,000 lb. in 1943, with production scheduled to rise to 36,000,000 lb. in 1944.

To summarize, the cellulose resins as a group are finding important uses in the war program. At the close of 1943, production for the entire group, including acetate for rayon, was at a rate of 360,000,000 lb. per year. Rayon was receiving 62 percent of the total. Plastics and film uses took 27 percent, and the balance, or 11 percent of the production, was used for protective coatings, special printing inks, and the like.

The chemicals required for the cellulose group are: coal, limestone, salt, and sulphur as basic or elemental materials. Acetylene, acetaldehyde, acetic acid, acetic anhydride, ammonia, butane, butyl alcohol, butyric acid, calcium carbide, caustic soda, chlorine, hydrochloric acid, ethyl alcohol, ethylene, ethyl chloride, formaldehyde, isopropyl alcohol, ketene, propionic acid, nitric acid, and sulphric acid, are all required as intermediate chemicals.

The demand on certain of these chemicals is quite significant. For instance 46 percent of the acetic acid and over 90 percent of the actic anhydride are consumed in making these cellulose resins and cellulose acetate rayon. A large facility is now being constructed in order to provide additional acetic acid to meet the future demand for increased rayon production for civilian requirements.

Vinyl resins constitute a second group of the thermoplastic resins. Included in the vinyl group are polymers of styrene, isobutylene, methyl acrylate, methyl methacrylate, vinyl acetate, vinyl butyral, vinyl chloride, vinyl formal, vinyl alcohol, and certain co-polymers, such as the well-established vinyl chloride-vinyl acetate combination, or the newer vinyl chloride-vinylidene chloride resins.

Styrene for production of polystyrene is now restricted for military uses in plastics. The other allowed usage is for the production of synthetic rubber. Polystyrene for plastics will be limited to those uses where it is considered indispensable. Current production of polystyrene is about 4,000,000 lb. per year. The total production of monomeric styrene has been expanded from 15,000,000 lb. in 1940 to a total of 350,000,000 lb. in 1943, with 405,000,000 lb. projected for 1944.

Benzol is the basic raw material for the production of styrene. It is combined with ethylene to form ethyl benzene from which two atoms of hydrogen are removed to form monomeric styrene. Over 27,000,000 gal. of benzol per year are now going to make styrene. This is almost the equivalent of our total prewar production of refined benzol. These benzol requirements have been an important factor in preventing the use of benzol or its derivatives for anything but military or extremely important civilian purposes.

Isobutylene is produced by the dehydrogenation of isobutane. This resin has been extremely useful as a rubber substitute in certain types of electrical insulation. Its use has been restricted to military and a few important civilian items.

Methyl acrylate, methyl methacrylate, and other special acrylates, have been used almost exclusively for military purposes. Production was expanded from about 19,000,000 lb. in 1941 to 37,000,000 lb. in 1943, and the capacity is expected to reach 50,000,000 lb. in 1944, with actual production at a somewhat lower level.

The methyl acrylate resins start with ethylene chlorohydrin which is reacted with sodium cyanide to form hydracrylic nitrile which can be combined with methanol to form the monomer of methyl acrylate.

Methyl methacrylate starts from acetone which is reacted with hydrogen cyanide to form acetone cyanohydrin which is combined with methanol to form the monomer of methyl methacrylate.

Vinyl acetate is an intermediate in its monomeric form. It is used in the production of sulfa drugs, polyvinyl alcohol, polyvinyl butyral, polyvinyl formal, and polyvinyl chloride-acetate. Vinyl acetate is produced either directly from calcium carbide or from acetylene produced from it. The acetylene is reacted with acetic acid in the presence of a catalyst. Sulphuric acid is required in the process.

The use of polyvinyl acetate has been restricted to a high order of essentiality. Currently, shoe adhesives are the marginal use and, in this application, vinyl acetate is replacing rubber. Production of the monomer in 1941 was 15,000,000 lb. This was increased to 40,000,000 lb. in 1943, and in 1944 the capacity will be 50,000,000 lb.

The group consisting of polyvinyl acetate, polyvinyl alcohol, polyvinyl chloride, polyvinyl butyral, and the co-polymers of vinyl chloride and vinyl acetate are most extensively used for rubber replacement. At the present time, total military demands cannot be met in full. Nevertheless, a few highly essential civilian uses are permitted. A small amount of scrap material is allowed to flow into essential civilian uses because the material cannot be reconditioned for a military use. Production of this class of vinyl resin has been sharply increased from a total of 18,000,000 lb. in 1940 to 83,000,000 lb. in 1943 and with 108,000,000 lb. capacity to be available in 1944.

To summmarize, the entire vinyl resin group has been expanded from a production of 72,00,000 lb. in 1941 to 178,000,000 lb. in 1943, with 1944 production projected at 212,000,000 lb. Of this production, 30 percent is used for protective coatings and adhesives and 70 percent goes into plastics. The styrene for synthetic rubber is not included in the above figures.

The chemical requirements for the vinyl group are most significant. Raw materials include acetic acid, acetic anhydride, acetone, acetylene, benzol, butyl alcohol, butyric acid, calcium carbide, caustic soda, chlorine, cholohydrin, cyanamide, ethylene, ethylene dichloride, ethylene oxide, isobutane, isobutylene, methanol, sodium,

Urea formaldehyde resin being mixed. Production of urea resins has increased from 22,000,000 lb. in 1940 to 115,000,000 projected for 1944

sodium cyanide, vinyl alcohol, and vinyl acetate.

Rubber derivatives constitute a third group of thermoplastic resins. These are chlorinated rubber, rubber hydrochloride, and isomerized rubber. In spite of the critical rubber shortage, limited quantities of these resins are still being manufactured for uses where there is no known substitute.

The miscellaneous group of thermoplastic resins include the widely used coumarine-indene resins and the resins derived from beta-pinene. These resins have found a wide utility in the war program and continue to be used in many civilian applications. To date, the supply has been adequate for all needs. There is no immediate problem in the raw materials, which are coal-tar distillates, turpentine and sulphuric acid. Production capacity for these types has not been expanded during the past three years and is believed to be in the order of 55,000,000 lb. per year for all grades.

POLYETHYLENE

Polyethylene is an important new resin that has been put in commercial production in order to meet important military demands. This resin should find many useful industrial applications in the postwar era.

In the aggregate, the production of these resins consumes a significant proportion of the production of many chemicals. Under war conditions and because of military demands, some of these chemicals, such as benzol and butyl alcohol, are in critical supply. Therefore, any resin, which requires such a critical component in its manufacture, can only be used for purposes having an essentiality equivalent to the other end uses of the critical components. For example, benzol is used for the production of: styrene for synthetic rubber; phenol for plastics; aniline for dyes, drugs, rubber chemicals, miscellaneous essential chemicals, and the balance of all available benzol is channelled to aviation gasoline. Therefore, the use of styrene or phenol for plastics and for other purposes must have an essentiality equivalent to aviation gasoline. In other words, if the resin use is indispensable to the war effort, including some essential civilian need, it is a justified use. The Chemicals Bureau endeavors to find these "common denominators" through the medium of allocation orders in which the producer applies for authority to make products for certain specific end uses. These applications are handled on a monthly basis for extremely critical materials and on a quarterly basis for the less critical materials. These allocations do not apply to materials in free supply.

There are three general groups of resins that may be classed as thermosetting. Those which will be discussed in this paper are the following: phenol-formaldehyde resins (including cresol and substituted phenolic resins), urea-formaldehyde resins (including melamine resins), and alkyd resins (including phthalic, maleic, and pentaerythritol types).

PHENOLIC RESINS

The phenolic resins are widely used for military purposes. This is partly because they are derived from benzol and hence usage must stand a rigorous essentiality test. Approximately 16 percent of the phenol for resins goes into those grades of resin required for protective coatings, the balance being the plastic grades.

Phenolic resins are made by condensing phenol or cresol and formaldehyde. Some phenol and most of our cresol is produced as a byproduct of coal-tar. However, by far the largest proportion of our current supply of phenol is made synthetically. Some cresol or cresylic acid is produced from petroleum and some is produced synthetically, but in neither case is the product considered fully suitable for resin production. There is, however, a limited production of petroleum cresylic resin that is quite useful.

The production of phenolic resins has been substantially increased to meet the war needs. In 1940, according to U. S. Tariff Commission reports, the industry manufactured 93,000,000 lb. of resin. This would be equivalent to 180,000,000 lb. when compounded for sale as molding powder, laminates, adhesives, and the other commercial forms.

The figures on production from 1942 have been as follows:

Year	Tar acid Consumption	Production Dry Resin	Production Resin Comp. as Sold
	(In millions of pounds)		
1942	104	116	217
1943	137	152	300
1944	158	176	346

The 1943 production of phenolic resin compound was divided as follows:

Molding powders	100,000,000 lb.
Laminates	80,000,000 lb.
Specialties	50,000,000 lb.
Protective coatings	36,000,000 lb.
Adhesives	34,000,000 lb.

The principal chemicals required for this production include: benzol, caustic soda, chlorine, cresylic acid, formaldehyde, methanol, monochlorbenzene, phenol, sulphuric acid. About 16 percent of our benzol goes into synthetic phenol. Phenolic resins consume 62 percent of this phenol. About 46 percent of our methanol is converted to formaldehyde, and 31 percent of the formaldehyde is consumed by the phenolic resin industry. In order to meet these requirements, it has been necessary to construct new facilities for phenol and formaldehyde. This, in turn, has required new facilities or new sources for all of the other chemicals required to produce phenol and formaldehyde.

Urea-formaldehyde resins are becoming increasingly important in the war program. They are widely used as adhesives, and over 80 percent of this use is for military purposes. In the molded materials, civilian uses predominate. However, the melamine resins are used almost entirely for military purposes.

The production of this group of resins has increased markedly in the past four years. In 1940, the Tariff Commission reports indicated a total production of 22,000,000 lb. In 1942, 40,000,000 lb. were produced. For 1943, the production has been estimated at 100,000,000 lb., and 1944 is projected at 115,000,000 lb.

The principal chemicals required for this group of resins are: ammonia, calcium carbide, carbon dioxide, cyanamide, formaldehyde, melamine, methanol, urea.

In making these resins there is consumed over 50 percent of the urea production and nearly 40 percent of the formaldehyde. In order to meet the heavy increased demand for these resins, it has been necessary to build facilities for the raw materials as well as the resins themselves. Alternate uses for ammonia and methanol will determine how much formaldehyde can be used for resins for civilian end uses.

ALKYD RESINS

Alkyd resins are used chiefly by the protective coatings industry.

Naphthalene is combined with oxygen to form phthalic anhydride which is then reacted with glycerine to form glycerol-phthalate which, in turn, is modified with a drying oil to produce the finished alkyd resin. Another type is produced from maleic anhydride and glycerine. Still other modifications are made by substituting pentaerythritol for glycerine in the reaction with the anhydrides or other dibasic acids. For a time during 1942 and early in 1943 glycerine was in short supply which greatly restricted the civilian use of alkyd resins. As a result of improved glycerine supply, more alkyd resins were produced during the latter half of 1943. However, phthalic and maleic anhydride availability have now halted production at a level of 170,000,000 lb. per year.

The chemicals required for the alkyd resin group include: allyl alcohol, ammonia, benzol, carbon dioxide, coal tar, dipentene, glycerine, linoleic acid, maleic anhydride, methanol, naphthalene, pentaerythritol, phthalic anhydride, rosin, Sorbitol.

Approximately 66 percent of our naphthalene production now goes into phthalic anhydride and over 40 percent of the latter chemical is converted into alkyd resins with another 47 percent going into chemical plasticizers. Thus, about 87 percent of our phthalic anhydride may be said to be consumed directly and indirectly for synthetic resins. There is, however, a substantial amount of the current production of phthalate esters being used for non-resin military purposes.

In general, the synthetic resins require plasticizers or softeners to modify their physical characteristics to meet particular requirements. The thermoplastic resin uses are the major consumers of these plasticizers. Chemical industry has provided for this demand to supplement castor oil and camphor which were widely employed in the early days of synthetic resin development. It has been stated that there are 30 manufacturers producing 150 different chemical plasticizers. There are probably a number of new chemicals that have been found useful during the past few years which would increase both totals. However, the list of known chemicals which may be called plasticizers will be many times 150. Unfortunately, only a comparative few are really useful in compounding synthetic resins. On the other hand, it is indeed fortunate that the different resins require somewhat different plasticizers in most of their applications.

By far the largest number of plasticizers are made by combining an alcohol, ether or ether-alcohol with an acid or an anhydride. A group of this type are the phthalate plasticizers, diethyl, dimethyl, dibutyl, diamyl, dicapryl, and diactyl phthalate. The corresponding alcohols, ethyl, methyl, butyl, amyl, capryl or octyl, are reacted with phthalic anhydride to form the esters. The ether-alcohol esters are also quite important phthalates.

Among the organic acids making esters useful as plasticizers are the following: abietic, acetic, adipic, benzoic, butyric, caprylic, citric, glycolic, lauric, linolenic, maleic, oleic, phthalic, propionic, ricinoleic, sebacic, stearic, tartaric, and toluene sulphonic.

Phosphoric acid is the principal inorganic acid which appears in plasticizer form. The first chemical plasticizers to attract attention were tricresyl phosphate and triphenyl phosphate which were found useful with nitrocellulose as a replacement for camphor. The chemicals required for the production of the various phosphate plasticizers include: coal-tar, benzol, cresylic acid, phenol, phosphoric, chlorine, phosphorus oxychloride, phosphorus pentoxide, caustic soda, and in addition various alcohols.

SPECIALTY PLASTICIZERS

In addition to these broad groups, there are a few specialty plasticizers deserving separate comment. The amyl naphthalenes, glycerol triacetate, chlorinated biphenyl, and the nitriles are all important for certain special purposes.

There are no early records on plasticizer production which are wholly adequate for reference, however, the following table has been prepared from data which are available. It is presented in the hope that it will serve as a comparative measure of the ratio of chemical plasticizer production to thermoplastic resin production.

Plasticizer-Resin Production Ratio

	1941	1943	Estimated 1944
Chemical plasticizers*	70	130	136
Thermoplastic resins[†]	224	363	418
Ratio, lb. plasticizer per lb. of resin	.312	.359	.325

* These figures do *not* include dibutyl phthalate and dimethyl phthalate produced for smokeless powder and insectifuge purposes. The figures do not include any soybean, castor or linseed oil plasticizers. Camphor is included.

† The resins in this group are the plastic and lacquer grades of the cellulose group, the vinyl group, and the coumarine-indene, and other miscellaneous thermoplastics.

The wide use of vinyl resins for rubber replacement probably necessitated higher plasticizer ratios in many formulations. This might account for the higher ratio in 1943. If so, we may expect a shortage of chemical plasticizer in 1944 unless the use of synthetic rubber relieves the demand for the vinyl resins.

The use of synthetic resins has created a tremendous demand for new chemical solvents. These solvents are required in processing and in application. The protective coatings industry is by far the major consumer of these various solvents. In general, each class of synthetic resin will yield the best results in some special class of solvent. Moreover, each application will require special solvent properties because of some conditions connected with the method of application, time cycle or mechanical limitations.

The coal-tar solvents, benzol, toluol, xylol, and solvent naphtha, are widely used both as solvents and diluents. The demands for benzol for aviation fuel and synthetic rubber have practically eliminated its use with synthetic resins. Toluol has been required for the production of TNT. More recently, any xylol not required for extremely essential protective coatings uses has been turned over to aviation fuel. Thus, use of the principal coal-tar solvents has been restricted so far as synthetic resins are concerned.

This has placed an added burden on the various esters and ketones. It has made it necessary to provide increased production facilities for the finished solvents and, in many cases, a number of intermediate chemicals.

The ester solvents, such as ethyl acetate, butyl acetate, etc., are made by reacting the corresponding alcohol and acetic acid. Thus, it is first necessary to translate our requirements back to the alcohols, for the bulk of our acetic acid is made from ethyl alcohol. The production of the acetate solvents currently consumes about 20 percent of our acetic acid production. Owing to the heavy military demand for these esters, practically no civilian use is authorized.

In 1941 the production of the principal items in this group of esters was estimated at 210,000,000 lb. In 1943 this production has increased to 212,000,000 lb. The solvents included in the above figures are ethyl acetate, normal butyl acetate, secondary butyl acetate, isopropyl acetate, and pentacetate.

The use of butyl acetate is far greater than normal. This is because of its strong solvent power for many synthetic resins. The boiling point and evaporating rate are about the same as toluol. In the past the shortage of acetic acid discouraged increasing the ester productive capacity. At the present time, we could advantageously use considerably more butyl acetate. Steps have been taken to increase the production of butyl alcohol which must be made available before an increase in butyl acetate can be realized. In the meantime, military needs are being met.

The alcohols have many important uses as resin solvents. Methyl, ethyl, butyl, isopropyl, and amyl are used to varying degrees. However, only a small percentage of the total production is used directly as solvent. The Cellosolves are ether-alcohols and are useful because of their high solvent power and slow evaporation. They are used with many different resins in a wide variety of applications.

KETONE SOLVENTS

The ketones are another group of solvents of special significance. Acetone, diacetone, methyl ethyl ketone, cyclohexanone, methyl isobutyl ketone, and isophorone are the principal ketones in general use as solvents for resins. Virtually all civilian end use of these ketones has been eliminated because of the requirements for direct and indirect military purposes. Acetone has many important uses aside from its solvent use. It is used in the manufacture of other ketones, acetylene, synthetic resin, explosives, and acetic anhydride.

Our production of these ketones has been increased from 331,000,000 lb. in 1941 to 505,000,000 lb. in 1943. Synthetic resin use and application will consume about 25 percent of the 1943 production. The balance will be for a variety of uses, including the conversion from one ketone to another as, for example, from acetone to diacetone alcohol which may be converted to methyl isobutyl ketone.

Finally, there are solvents produced from petroleum. These are useful with many of the synthetic resins either as solvents or diluents. At present, there are some grades that are off the market due to the aviation gas program. The aromatic petroleum solvents have been in great demand as coal-tar solvent replacement. The current usage has been considerably restricted in order to insure adequate supplies for military and most essential civilian uses.

During the war period we will have learned better formulations for resin products. The fabricators of plastics have developed new techniques which have increased their potential uses for plastics. The commercial and civilian aviation development of the future should consume large quantities of resins. All told, the future looks promising for the chemical and synthetic resin industries.

FROM THE VIEWPOINT OF THE EDITORS—

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LABOR, TOO, HAS ITS PLANS

Spring is in the air, and hopes for an early peace have at last, perhaps prematurely, begun to warm the hearts of men. Budding plans for our postwar future are beginning to blossom in every industry. Labor leaders, not to be outdone by the capitalistic planners, hasten from their holes of patriotic hibernation to cast their own postwar shadows before them—and, incidentally, to grab a few pies while the grabbing is good.

These shadows are worth close watching, for a large number of labor planners are growing increasingly more coherent regarding demands for postwar job security and income. This trend has an immediate significance to chemical employers, who should begin considering these demands now—not after an ultimatum has been issued.

Such demands, according to the Labor Relations Institute, are crystallizing into well-defined patterns. The "Guaranteed Wage Agreement," increasingly popular, has a number of variations: (1) the "2,080-hour clause," which would provide for guaranteed employment for that many hours per year. (This is actually equivalent to 52 weeks of 40 hours each.) (2) The "partial guarantee" which would permit seasonal fluctuations to affect only a certain part of the staff; (3) the "volume-of-business" clause in which the percentage of employees guaranteed steady employment would increase in proportion to the growth of business volume; (4) the "annual bonus plan;" (5) the "52-pay-check plan," which would provide employees with some compensation every week of the year, whether they earned it or not.

More and more unions are pressing for two-year agreements, with the goal of sustaining wages and union strength at present levels, despite reconversion letdowns! So far, however, the War Labor Board has indicated that it will not force employers into two-year pacts against their will.

Granting of severance pay by companies which cannot point to past policy may be interpreted as a "hidden" increase and hence a violation of the Wage Stabilization Act.

Now that Congress has provided a "mustering out" pay for soldiers, comparable payments for war workers are being pressed by some labor leaders, and it appears inevitable that some scheme will emerge—probably in the form of compelling industries to set aside "rehabilitation" funds for employees who are laid off. The Labor Relations Institute has warned its members to hold off on severance pay pending clarification in Washington, unless they already have established plans which were in force prior to the passage of the Wage and Salary Stabilization Act.

Such, then, is the basic nature of some of the plans of the labor leaders which will add seriously to management's problems after the war. Regardless of the shape and shade of these individual plans, one master plan is clearly emerging: those labor unions, leaders and individuals that did not hesitate to hold up the war effort in America's most critical moments certainly do not intend to tremble before the prospects of wrecking the economic structure of postwar industry.

MORE MARKETS AT LOWER PRICES?

Postwar marketing studies must give increased attention to volume and price relationships. This is particularly true at this time when many chemical industries are getting ready to market their products at prices very much below those which prevailed five years ago.

Questions of this sort require much more than the usual sales approach. The director of research and the production manager are almost equally involved. Every product must be studied to determine how much more could be sold for new uses if a new price schedule or a new quality of product could be adopted as standard. These problems must be studied just as thoroughly for old products as for new ones.

As the postwar opportunities of lower costs develop it will be important to identify as soon as possible those new markets which are opened to the industrial chemical producers at new price levels.

AN INSIDE STORY FROM LOS ANGELES

One reads funny things in the newspapers, especially in Los Angeles. Recently we came across a story in the *Daily News* about a potential byproduct of the fallen-animal industry which our good friend Dr. Robinson seemed to have overlooked in his excellent but slightly unappetizing article last August. The *News* refers to the experimental manufacture of paper from an amazing and hitherto unused source of cellulose. "This source of raw cellulose," it reports, "which is ideally adapted to paper making because some of it has already undergone two elementary steps in the process, (maceration and digestion), is grass and hay from the stomachs of slaughtered cattle."

The Los Angeles inventor, one W. D. Hoppie, has applied for a patent on the new paper-making process and is making arrangements to license its use. Already to his credit is the Hoppie process for making quinine from sagebrush, which according to the *News*, is now being exploited by a local manufacturer.

Hoppie, who had been taken in by the old saw about the packers using every bit of the pig, including the squeal, was amazed to find large piles of semi-digested hay recovered from the storage stomachs of cattle being slaughtered at a local abattoir. Here was some good raw mate-

rial going to waste so he decided to put his inventive mind to work.

"When wood or cornstalks (?) are made into paper," according to Mr. Hoppie, "the first thing done is to moisten the stuff, then grind it up and soak it in hydrochloric acid (?) (The question marks are ours—Ed.). Exactly this same thing happens when a cow eats. First grass or hay is cropped and swallowed. Then it passes through a series of two or three stomachs of the animal where the food is moistened and bacterial action begins to convert the less resistant or non-fibrous cellulose into sugar."

Finally, after a further maceration and recycling (regurgitation) during the cud-chewing stage, the material passes to the fourth stomach for its digestion with HCl. (It is in this stage that Mr. Hoppie prefers to recover his cow-pulp and his investigations showed that as much as 85 tons per week were available from the local packers. He has been told that much larger amounts might be obtained at such midwestern packing centers as Kansas City and Chicago, but, as a loyal Californian, he believes that "western cattle whose food consists largely of grass, would prove a better source of paper-making fiber than the cornfed cattle of the Midlands."

Some there are who will hold that Brother Hoppie is as "balmy" as the climate of which California sometimes boasts. However, in these days of pulpwood shortages and the difficulty in obtaining stainless steel digesters, we can't be too sure he hasn't got something good—especially if he can make up the cow paper into nice, crisp, prettily engraved stock certificates to be sold to gullible newspaper reporters and chief editors in California's City of the Angels.

IS UNDERGROUND STORAGE FEASIBLE?

Chemical engineers must face a new problem of conservation which has political as well as technical angles of great importance. In fact, it appears that the political considerations of underground storage of fuel and mineral reserves may become dominant. Under these circumstances it is all the more important that the technical angles be first understood. Then our profession can exert its maximum influence in the right direction, even though we may not altogether eliminate decisions based on political expediency.

The basic question is likely to become very simple. Perhaps it could well be stated this way: Shall we exhaust our domestic resources of natural gas, petroleum, and strategic minerals to furnish employment in the United States; or shall we conserve them for the future and use more imported raw material?

For a few commodities there is a middle course. We can actually repressure natural gas wells and petroleum sands by pumping back into the ground either gas or liquid fuels. In some parts of the United States this is done with gas every year so that the long-distance pipelines may carry more nearly a capacity load in the seasons of light demand, and the user communities can take from the ground nearby supplies that could not be brought during peak-demand periods because of limited pipeline capacity. There is no doubt as to the technical feasibility. There seems little question as to the economic advantage for natural gas in a considerable expansion of this policy. But when one goes that far, he enters a new and uncharted field, especially in the case of petroleum.

It is now being proposed that we bring crude petroleum from abroad and pump it into the ground for storage. The advocates of that plan would have us simultaneously pump wells in areas that are still producing actively and produce much of our oil products from that domestic material. Obviously, they also anticipate that some of the crude run to stills will come from abroad. One does not need to have a keen imagination to see the multitude of labor and industry controversies that any such mixture of petroleum policies will present.

Still more controversial is the question of leaving our strategic minerals in the ground and using currently only foreign raw materials. Bauxite, manganese, lead and zinc, copper, and a half dozen other minerals and metals are going to be fought over in this area of debate and dispute.

There is no one answer to these questions. Nevertheless they must be faced, and the more technical facts that are presented for official consideration, the better will be the ultimate decision. Light rather than heat is needed now.

DEMOTING DE LUXE PACKAGES

Every sales manager wants to package his products most attractively. This is a commendable practice in peacetime for it promotes sales and pleases the customer even when the flossy packaging does not add any superior or intrinsic property to the goods.

Just now, however, we are faced with embarrassing shortages of practically all packaging materials—even in the case of barrels, drums and paper bags. To add unnecessarily to the cost of packing any product is unfair to other, perhaps, more essential users of packaging materials. In wartime, no commodity deserves a better package than it really requires. Each commodity should, therefore, be demoted to the lowest grade or type of package which will safely and properly deliver it to the customer.

When present shortages are over, we can again consider the promotional value of superior containers. Right now the chemical industry as a whole cannot afford such luxury as pretty packages.

LEO HENDRIK BAEKELAND, 1863–1944

The American chemical industry has lost one of its most distinguished inventors and business men. Dr. Leo H. Baekeland has passed away. He had developed the first synthetic resin, pioneered the modern plastics industry and lived to see it blossom into a young giant with remarkable vitality and promise. He served as president of the American Institute of Chemical Engineers, the Electrochemical Society, and the American Chemical Society. His fellow chemists and engineers had awarded him for his contributions to the progress of American science and invention, the William Perkins, the Willard Gibbs, the Chandler, the William H. Nichols and the John Scott medals. Dr. Baekeland was loved and respected by all who were fortunate enough to know him. He will be sorely missed.

CHEM. & MET. PLANT NOTEBOOK

THEODORE R. OLIVE, Associate Editor

War Bond Awarded Each Month

Until further notice the contest which was first announced in our November 1943 issue will be continued. For the best short article received each month and accepted for publication in the "*Chem & Met.* Plant Notebook," a $25 Series E War Bond will be awarded, in addition to payment at our usual space rate for this department. The award for each month will be announced in the issue of the following month. The judges will be the editors of *Chem. & Met.* Any item submitted may be published in this department, but all items so published will be paid for at our usual space rate for such material.

The contest is open to all readers of ***Chem. & Met.***, other than employees of the **McGraw-Hill** Publishing Co., Inc.

Any number of entries, without limit, may be submitted by one person. **Articles must be previously unpublished, and should be short, preferably less than 300 words, but should include one or more illustrations if possible.** Finished drawings are not required and literary excellence will not be a factor in the judging. **Winning articles will be selected on the basis of appropriateness, novelty and the usefulness of the ideas described.**

Articles may deal with any sort of plant or production "kink" or shortcut which in the opinion of the judges will be interesting to chemical engineers in process industries, as well as with cost reducing ideas, and novel means of presenting useful data. Material to be entered in this contest should be addressed to Plant Notebook Editor, *Chem. & Met.*, 330 West 42nd St., New York 18, N. Y.

January Contest Prize Winner

NEW METHOD OF PHOTOELECTRIC LEVEL CONTROL PREVENTS OVERFLOW OF STORAGE TANKS

THEODORE A. BECK
Industrial Engineer, A. O. Smith Corp., Milwaukee, Wis.

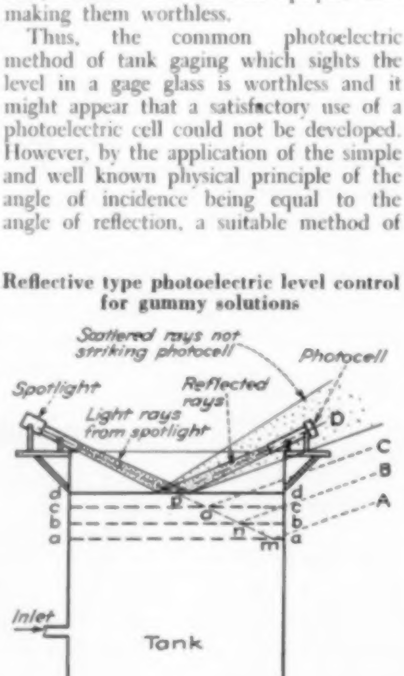
Many paper companies have had a considerable loss of paper coating solutions owing to the overflow of reservoir tanks located above the Fourdrinier machines. Like other solutions such a glue and starch, paper coatings tend to gum up ordinary level control equipment and make the equipment unreliable in operation. One particular company investigated several methods of control and still had to use the inefficient float system. After a lapse of many years of experimentation and failures, the idea discussed in this article was presented and developed successfully.

The new method conserves solutions effectively, preventing all waste from overflowing tanks caused by carelessness or by the inaccuracy of instruments, since it is impossible for the solution to pass the "full" level. The method requires little maintenance once the mechanism is adjusted. Filling becomes automatic once the pump is started, thus saving manpower, since no attendant is needed to watch the tank while it is being filled.

Various conditions have been found which cripple equipment used to control the filling of tanks. The mixing plant for coating solutions is generally at a considerable distance from the reservoir tank located over the paper machine, making necessary remote control for pumping the solution and keeping the reservoir full. Conventional methods, such as floats, air pressure systems, and gage glasses, rapidly become inefficient and lose their accuracy after a little use in the fast-drying viscous solution. Floats acquire "stalactitic" layers of the solution which continually increase their number and weight, thus making the float ride at an inaccurate and increasingly lower level. Air pressure systems readily become clogged since the orifice becomes filmed with a hardened solution which causes its calibration to become misleading. Finally, glass gages, after one or two uses, become covered and opaque, thus making them worthless.

Thus, the common photoelectric method of tank gaging which sights the level in a gage glass is worthless and it might appear that a satisfactory use of a photoelectric cell could not be developed. However, by the application of the simple and well known physical principle of the angle of incidence being equal to the angle of reflection, a suitable method of applying photoelectric equipment was worked out. The method is illustrated in the accompanying drawing and is evidently applicable to most types of liquids, since most liquid surfaces will reflect sufficient light to operate the equipment.

Reflective type photoelectric level control for gummy solutions



The spotlight-type light source is mounted at an angle at one side of the tank, throwing the beam so as to strike the solution approximately at the center of the tank when the level is at the desired maximum. The photoelectric cell is then situated on the opposite side of the tank and pointed so as to receive reflected light from the spot on the solution illuminated by the lamp. This is best done experimentally.

How the control works when the solution is at various levels will be clear from the sketch. When the solution is at levels *a-a*, *b-b*, or *c-c*, the light will be reflected from points *m*, *n*, and *o*, along the lines *mA*, *nB*, and *oC*. Only when the solution level is at *d-d* (i.e., a full tank) will the light reflect from point *p* along line *pD* and thus strike the photoelectric cell which by means of a relay system will turn off the pump as this level is reached.

FEBRUARY WINNER!

A $25 Series E War Bond will be issued in the names of

D. M. PEPPARD
and
D. S. DAVIS
Wyandotte Chemicals Corp. Wyandotte, Mich.

For an article dealing with a substitute slide rule blank which has been adjudged the winner of our February contest.

This article will appear in our April issue. Watch for it!

Nomograph for percentage tolerances

NOMOGRAPH FOR ANALYZING PERCENTAGE TOLERANCES

W. E. PATTE
Engineer
Brownsburg, Que., Canada

Many non-mathematically inclined engineers do not appreciate the importance that the size of a sample has in determining the significance of percentages derived from it. For example, if 0.5 percent scrap is considered satisfactory in a certain operation, and if one unit in a sample of 50 is scrap, does this 2 percent of scrap indicate that the sample is poorer than average? On the face of it, the answer might be yes, except for the fact that in a sample of 50, with any scrap at all, the least possible percentage would be 2 percent.

The proper approach, of course, is through mathematical statistics, employing the theory of small samples, which has yielded the formula $\sigma = \sqrt{Q(100-Q)/N}$ where σ is the standard deviation of the reference percentage; N is the size of the sample; and Q is the standard or reference percentage. The equation is conveniently solved by the accompanying nomograph. The significance of a percentage arrived at by means of a sample is determined by its relation to Q and σ. If the percentage is outside the value of $Q \pm 2\sigma$ the percentage is probably significant. If outside $Q \pm 3\sigma$ it is extremely significant.

Examples of Use

The use of the nomograph will be clear from a number of examples, including the aforementioned example dealing with scrap:

Example 1—It has been found that an operation may be run satisfactorily at 0.5 percent scrap. When 50 objects are examined, one is found to be scrap or 2 percent of the sample. Is this production poorer than standard? In this case $N = 50$ and $Q = 0.5$ percent. Therefore, σ from the nomograph, is found to be 1 percent. From the rule mentioned above, significant percentages will be those outside $0.5 \pm 3 \times 1$. However, the percent obtained is not even of probable significance since it is less than $0.5 + 2$ percent. The production sampled is not therefore significantly poorer than standard quality.

Example 2—A plant is operating at 8.0 percent absenteeism, based on the number of working hours. In a small department, 71 hours is lost in a total of 750 hours work, or a percentage of 9.5 percent. Another department loses 690 hours out of a total of 7,500, or a percentage of 9.2 percent. Which department has the poorer record?

The standard for the plant is 8 percent. In the first case, connecting $N = 750$ with $Q = 8.0$ yields $\sigma = 0.95$. Therefore, a percentage absenteeism outside $8.0 \pm 2 \times 0.95$ is probably significant, while a percent absenteeism outside $0.8 \pm 3 \times 0.95$ is extremely significant. The percentage for the small department, namely, 9.5, is within both limits.

For the larger department, connecting $N = 7{,}500$ and $Q = 8.0$ yields $\sigma = 0.31$. A percent absenteeism outside $8.0 \pm 3 \times 0.31$ for this department is extremely significant. This amounts to a range from 7.1 to 8.9 percent. Since the larger department has an absentee rate of 9.2 percent, the difference from the standard is more significant than that of the smaller department with a higher absentee rate.

Example 3—Suppose that the standard moisture content for a certain material is 10 percent and that the usual test sample is 5 gram, weighed to four decimal places before and after evaporation of the moisture. In this case, $Q = 10.0$ and $N = 50{,}000$ (5 plus four significant figures). From the chart $\sigma = 0.14$ percent. From the rule, a sample percentage outside $10.0 \pm 2 \times 0.14$, or 9.7 to 10.3 percent, is probably significant, while sample percentages outside $10.0 \pm 3 \times 0.14$ are extremely significant.

If all tests of samples are made in duplicate, combined sample size then becomes 100,000 and the chart gives a value of σ of 0.10 percent. In this case the combined sample percentage will probably be significant if it is outside $10.0 \pm 2 \times 0.10$, or 9.8 to 10.2 percent, and it will be definitely off standard quality if outside $10.0 \pm 3 \times 0.10$, or 9.7 to 10.3 percent.

If, however, the weighings before and after driving off the moisture content are not made so accurately, say, to three decimal places, then the leeway must be greater. In this case, for a single test, $N = 5{,}000$ and $Q = 10$ percent, so that $\sigma = 0.42$ percent and sample percentages outside $10.0 \pm 3 \times 0.42$, or 8.7 to 11.3 percent, will be extremely significant. Obviously this method will give an immediate benefit when applied to several different analyses in that the specification tolerances for all analyses will be mathematically identical. When sample percentages consistently fall outside $Q \pm 3\sigma$, this is a definite indication of lack of precision in the method of analyzing, or lack of control of the variable, or both.

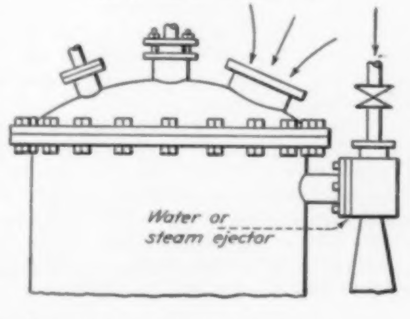
USING AN EJECTOR FOR DUST ELIMINATION

W. A. WELCH
Philadelphia, Pa.

In many chemical processes, it is necessary to add dry solids through a manhole into a tank or kettle for mixing with a hot liquid. For example, it may be necessary to add activated decolorizing carbon, diatomaceous earth, or certain dry chemicals which can create a dust nuisance owing to the natural up-draft of vapors rising from the liquid in the treating tank.

The accompanying diagram illustrates one method of overcoming this difficulty by installing a water- or steam-operated ejector at the side of the vessel near the level of the manhole. When the dusty material is to be introduced into the tank, the ejector is turned on, thus creating a substantial down-draft through the manhole and eliminating the dusting. In addition to overcoming the dust nuisance, this device results in some saving of material since it is possible to lower the bags or containers directly into the manhole where the entire contents can be conveniently shaken out.

Steam or water ejector prevents dust rising from a manhole



HOW TO CHECK UP ON ENGINEERING REPORTS

D. S. DAVIS
Wyandotte Chemicals Corp.
Wyandotte, Mich.

Following are suggestions for examining engineering reports which are drawn from discussion, oral and written, with (1) several well-known authors of chemical engineering texts and handbooks, (2) editors of technical journals, (3) practicing engineers, and (4) chemical engineering professors in some of the leading colleges and universities. They should be of assistance to those who are (1) preparing material for publication, (2) responsible for correct and well-written engineering reports, and (3) spending a great deal of time checking reports written by engineering students.

General—A report should be read once, at the usual reading rate, for sense and logic and twice, slowly and at intervals for typographical, computational and other errors. During the latter readings literally everything should be questioned and an attitude which accepts little on trust is generally helpful.

Text and Proof—The author is usually not his own best proofreader since he tends to read with his memory rather than with his eyes and frequently overlooks glaring and seemingly obvious errors. However it is necessary for him to examine final drafts and galley proof at least once in order to

make the inevitable changes and to answer the manuscript editor's queries.

Team-work is worth while: in reading the galleys a typist or technical assistant should follow the manuscript while the author reads aloud from the proof. The second reading can often be done by a typist or assistant without the aid of the author. Girls usually excel in attention to detail and make better proofreaders than men. One reading, in tandem, suffices for page proof and the author should be one of the participants since it is his last chance to make a few, preferably a very few, corrections.

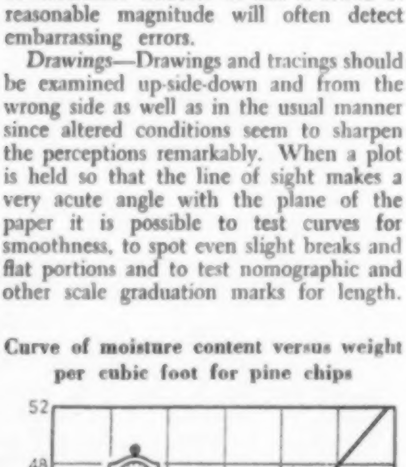
Reading aloud, even when working alone, is helpful since it slows one to an efficient rate and reveals unfortunate repetitions, rhymes, distracting words and "verbal bums." Proof should be read in small amounts, never more than an hour at a time and in the morning when one feels fresh or after a brisk walk. When particularly crowded, 15 minutes spent outdoors or in a relaxed position on even a table top will work wonders!

Calculations—Each step of every computation should be examined carefully and checked with a colored dot if correct. Particular attention should be given to the location of the decimal and to algebraic signs. In addition to the slide rule some of the rapid means of checking numerical computation should be employed, such as testing addition by casting out nines and multiplication and division by noting the terminal digits in the factors and product. Mere inspection of a calculated quantity to determine whether or not it seems of reasonable magnitude will often detect embarrassing errors.

Drawings—Drawings and tracings should be examined up-side-down and from the wrong side as well as in the usual manner since altered conditions seem to sharpen the perceptions remarkably. When a plot is held so that the line of sight makes a very acute angle with the plane of the paper it is possible to test curves for smoothness, to spot even slight breaks and flat portions and to test nomographic and other scale graduation marks for length. The line of vision should be perpendicular to the scale when checking for omissions of graduation marks and for uneven or inequitable spacing. Vertical legends, dimensions, and numbering should always be brought into a horizontal position for examination since superficial attention results when there is even a small amount of eye-strain.

Common Errors—The most frequent errors include split infinitives, disagreement in number between subject and verb, Spoonerisms, misspelling, inconsistent styling, colloquialisms, incorrect and incomplete references, and interchanged figure and equation numbers. Particular attention should be given chemical formulas and equations, mathematical material, abstracts and conclusions. Indexing should always be tested for coverage.

Curve of moisture content versus weight per cubic foot for pine chips



RAPID METHOD OF DETERMINING MOISTURE IN WOOD CHIPS

MALCOLM G. LYON
Champion Paper & Fibre Co.
Canton, N. C.

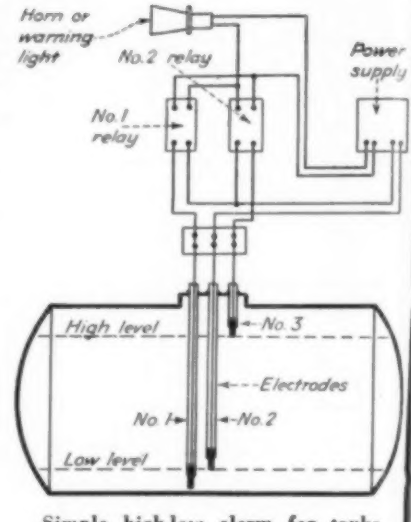
Moisture content of wood chips greatly affects the amount of wood to be put into a pulp digester, and is a factor to be considered when computing liquor volumes and concentrations. To obtain uniform cooking, it is therefore necessary to know the moisture content of the chips in each digester.

Weighing a standard can or pail which is just level full with moist chips is the simplest and quickest method of obtaining the moisture percentage for a sample representative of the chips charged into a digester. Within the normal range of chipping, there is not sufficient variation in chip size to affect the accuracy of this testing method. Also, it is readily possible to fill the standard can in such a way that bulk density variations will not affect the results significantly. Wood chips cannot be packed to any appreciable extent and a few shakes and jars will settle them to a stable position.

A suitable method of filling the can is to fill it about one-third full and shake briefly by lifting and dropping the can 2 or 3 in. several times. The same procedure is then repeated with the can two-thirds full and again when full. The can is then leveled off at the top with any additional chips necessary and weighed.

Simple and inexpensive equipment can be used for this test. A 1-cu.ft. pail can be constructed easily, or the result can be calibrated for a pail of other dimensions. A common milk scale, which can be set to give a zero reading with the empty pail and can be hung anywhere, is suitable for the weighing. The total cost of the equipment is only about $15 and results can be read well within 2 percent of the correct moisture percentage.

The accompanying chart shows a curve of moisture content versus weight which was prepared here for pine chips. A similar curve should, of course, be prepared for the type of chips being used. The chips can readily be sampled throughout the loading period of the digester, or they can be taken from the chip conveyor.



Simple high-low alarm for tanks

HIGH-LOW ALARM FOR ACID TANKS

J. F. FURRH
Instrument Foreman
Monsanto Chemical Co., Waskom, Tex.

The accompanying drawing illustrate[s] a simply constructed high-and-low-leve[l] alarm for acid tanks (or tanks containin[g] other corrosive, conductive liquids) whic[h] does not require scarce materials.

The electrodes, of which there are three, are made of Pyrex glass tubing, with a carbon plug in the lower end to mak[e] contact, the plug being connected to a top connection with a single insulate[d] wire. No. 2 electrode is common to both high and low circuits. No. 2 electrode a[nd] the low-level contact, and No. 3, the high level contact. The relays are selected s[o] that relay No. 1 is open when energized while No. 2 is closed when energized. An[y] suitable power source can be used. Lo[w] voltage can be used on the electrodes b[y] selecting relays with low-voltage operatin[g] coils.

No. 1 electrode is connected to No. [1] relay, No. 2 electrode to the hot side o[f] the power supply, and No. 3 electrode t[o] No. 2 relay. When the liquid rises hig[h] enough to touch No. 3 electrode, No. [2] relay closes and sounds the alarm until th[e] level has dropped below this electrod[e]. When the level drops below No. 2 ele[c]trode, No. 1 relay closes and sounds th[e] alarm until the liquid level has again ri[sen] high enough to touch this electrode. [If] desired, a pump may be connected to N[o.] 1 relay so as to start pumping when th[e] low level is reached, or to No. 2 relay [to] start pumping out of the tank when th[e] high level is reached.

IT'S DOLLARS TO DONUTS

that you have an idea worth publishing in the Plant Notebook section. If you haven't read the prize contest offer on page 116, do it now! Your article will bring at least $5 if accepted, and it may win a $25 War Bond in addition.

REPORT ON.....

CHEMICAL ENGINEERS

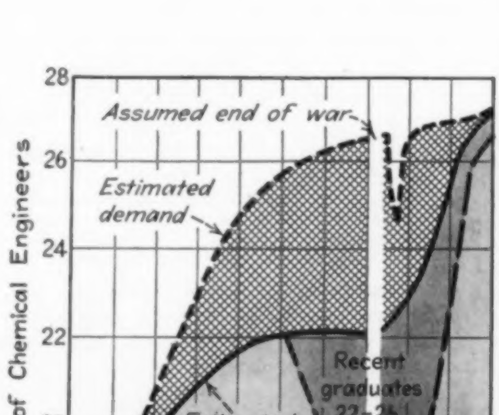
In War and Postwar Industry

Equally essential to America's production of a thousand and one vital materials of war is each of the chemical trio of equipment, skilled operators and engineers. Strategically located throughout our factories, these chemical engineers, largely under 30 years of age, have helped to mold industry in their own image. Some 22,000 of them are now accomplishing the greatest miracle in mass production of chemicals ever conceived and, at the same time, are catalyzing new technological developments at an unprecedented rate. Yet, now threatening the maintenance of this production and the acceleration of these developments is the tightening squeeze on industry to release to the combat army its technical men up to 26 years of age. Simultaneously, the supply of chemical engineering graduates has been effectively decimated, probably for years to come. What are the war contributions of these young engineers, what postwar problems must they solve? This report endeavors to indicate the answers.

AMERICA'S chemical industry may have been born in World War I, but there is no doubt that it has fully come of age during World War II. To soldier and scientist alike, it has become evident that "civilized" warfare is a mechanized destruction of physico-chemical forces, for always behind the machine and the machine shop is a chemical plant made possible by research chemists and maintained by chemical engineers. Backing our giant plane factories stand aluminum and magnesium lines, petroleum refineries that synthesize fighting fuels, oxygen units to save the lives of pilots, the alcohol and synthetic rubber industries, TNT, hexamine and other chemcials that make bombing missions effective.

Flame throwers, anti-malarials and sulfa drugs, dehydrated foods and potable sea water, tank turrets, plastic parts and camouflage paints, cartridge shells and blood plasma, battleships and booby traps—all depend, in their final analysis, upon chemistry and the alchemy of metallurgy for their perfection. Modern wars are fought by men, materials and technology: an inferiority, even slight, in any one of these can drag out or lose the struggle for the less progressive combatant.

Equally as important as the plants are our engineers, chemists, trained



Industry's estimated overall demand and supply of chemical engineers: danger lies in the gap that would result from loss of considerable men under 26 years old

operators and other technical personnel. Without these our chemical, process and mechanical plants would soon disintegrate as completely as the famous one-hoss shay. Let us investigate just one group, the chemical engineers, and find out where they are located and what they are doing.

HOW MANY AND WHERE

Chemical engineering, a young profession hardly existent at all prior to 1920, has come into its own largely since about 1935. In fact, of the estimated present total supply of 25,000 chemical engineers (including those in the armed forces), more than half have entered the profession since 1935.[1] Less than a year ago, the National Roster of Scientific and Specialized Personnel made a survey that covered over 14,000 professional chemical engineers and found the median age to be 26.8 years! This was by far the lowest median age of any of the groups in all the engineering, agricultural, medical, physical and social sciences.

It is probably true, though startling, that at least 10–12 percent of the nation's chemical engineers are under 22 years of age. Many of these, of course, are already in the armed forces. Yet, at least 1,500–1,800 of these young engineers are now in industry, representing probably 7–8 percent of all chemical engineers serving industry.[2]

With such a preponderance of young men, it is only natural that some concern should be felt by industry as to the effect that the loss of these young engineers would have on the continuation of the war effort. This report endeavors to analyze the present situation and to forecast the effect that the present trend in Selective Service thinking may have on our chemical and process industries for the duration of the war and during the early postwar years.

Up until the present, both state and national Selective Service officials have been highly cognizant of the part that engineers play in the war effort and leniency toward deferring professional chemical engineers has been the rule rather than the exception. Industry is highly appreciative of this intelligent and liberal attitude. The reaction of the local boards, as should be expected, has been spotty, so that many firms have found it necessary to put up a strenuous and running fight to retain their key men. This has been especially true of the smaller concerns.

Actually, industry as a whole has lost very few experienced chemical engineers to the armed forces, probably not many in excess of 500. Many of these were reserve officers. A number of young engineers with a year or less of industrial experience have been lost, partly because some firms did not press deferment claims with sufficient vigor and partly because the young engineers preferred to enter the services.

By far the largest loss, however, has been among the "engineers-to-be," the young graduates who leave for the armed forces directly from the graduating exercises. Probably about 2,500 chemical engineers belong in this category, making total losses about 3,000 or some 12 percent of the nation's estimated total supply. Thus, out of a total potentiality of about 25,000 chemical engineers, industry has at present a working supply of about 22,000.

The danger lies not so much in the number of engineers that have already been lost, although these are needed now more than ever, but in those that may soon be taken through "tightening up" processes by Selective Service at the very time that the supply of new graduates will be cut off almost completely. This double-barreled threat is reflected in two recent Selective Service directives, amended Bulletin 33-6 which reduces all engineering and science student deferments above the age of 18 to a total of 10,000 (exclusive of medical and theological), and amended Memorandum 115, which eliminates deferments for all registrants under 22 years old except in certain special cases.

THE SPRING DRIES UP

Engineering and scientific students that will graduate on or before July 1, 1944, of which there will be about 1,200 in chemical engineering, are still subject to deferment in more or less the usual manner until graduation and for 30 days thereafter. This month's grace is to permit the graduate to become employed in war industry. Probably at least half of these chemical engineering graduates are already committed to the armed forces, so that industry will have about 600 new graduates which it must try to get and then fight to keep.

To realize the seriousness of the situation, this graduating class of 1,200 should be compared to those of about 2,500 for 1943, 2,700 for 1942 and 2,400 for 1941.

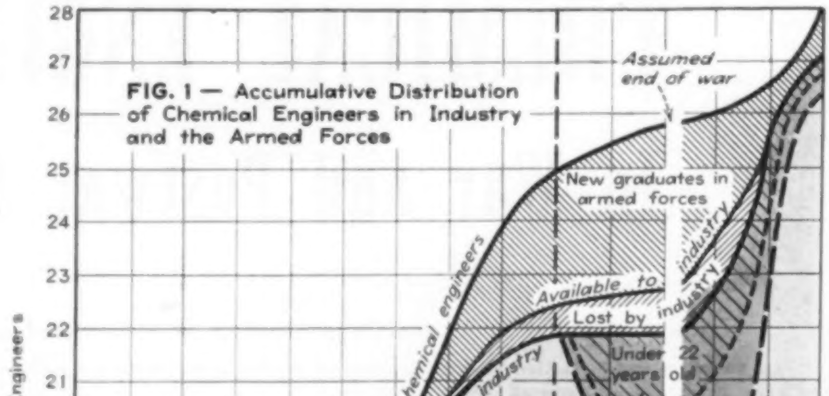


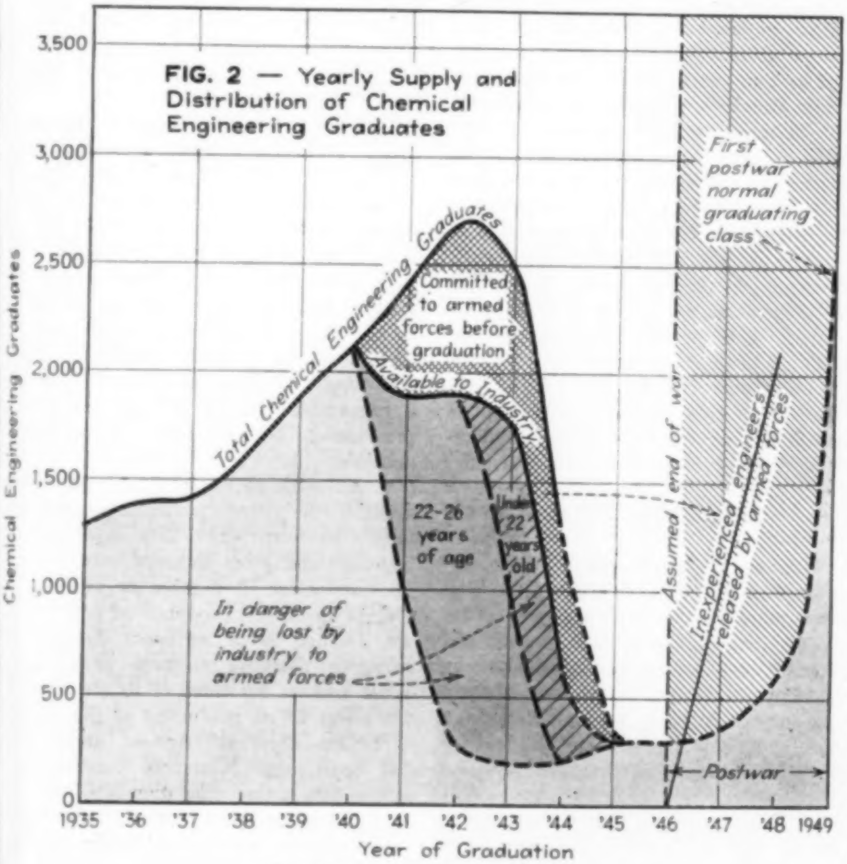
FIG. 1 — Accumulative Distribution of Chemical Engineers in Industry and the Armed Forces

[1] Due to the lack of exact and comprehensive data, the figures in this report, unless otherwise stated, represent the best estimates by the editors of *Chem. & Met.* They are intended to be indicative rather than absolute.

[2] Throughout this report, the term "in industry" includes all engineers actually not in the armed forces, since consultants, teachers, research workers and government employees are, almost without exception, contributing directly to industry's war effort.

of which probably 70 percent have been available to industry. Figure 2 shows the trend in size of graduating classes and the proportion of new graduates entering industry.

Amended Bulletin 33-6, effective March 15, 1944, states that "students occupationally deferred should be limited to a number sufficient to meet civilian needs in war production and in support of the war effort." The quota, which is exclusive of medical and theological students, was arbitrarily set at 10,000 to be graduated within 24 months after certification. The be small. How many will be in chemical engineering courses is not known, but the figure must necessarily be very small, probably not more than 6 percent of normal enrollment. Anyone who believes that such a picayune quota can ever amount to much more than as a teaser to industry's inflated war needs must be a super-optimist indeed, nor can anyone produce a convincing argument why less technically trained men are needed during a technological war than during peace time. Evidently Selective Service is committed to the theory of a short war. It is now esti-



EXPLANATION OF CHARTS

Fig. 1 shows the accumulative proportion of the nation's approximated total supply of chemical engineers entering the armed forces directly upon graduation, the experienced men lost by industry and those under 26 that may soon be lost. Fig. 2 shows the same data on a yearly basis, giving the distribution of each graduating class. Postwar conditions are visualized to show the two-year return of engineers to industry

total was divided somewhat as follows:

All engineering	6,750
Chemistry	2,250
Physics	850
Geology and geophysics	150

Thus, a total of about 6,700 engineering students of all types and classes above 18 will be deferred as compared to a total engineering enrollment of over 111,000 for 1942–43 (see Table I). Presumably, 4-F students will not be counted against this quota, but since such students do not amount to more than about five percent of total enrollments, the increment will mated that industry could very well use some 3,500–4,000 more chemical engineers alone, and last year the National Roster made a survey which indicated that essential manufacturing concerns would like to have had 12,000 engineers of all types just for the first six months of 1943.

This curtailment of deferable students together with the drastic reduction in the Army Specialized Training Program, 90 percent of which has centered around the training of engineers, from about 145,000 students to 30,000 advanced students by

Table I—Disappearance of Engineering Education—Our Source of Supply for Engineers Dries Up

Enrollment of Engineering Students at Colleges

	All Students	All Seniors	Chemical Engineering Seniors
1939–40....	105,900	17,700	3,200
1940–41....	110,600	17,700	3,000
1941–42....	110,500	18,100	3,200
1942–43....	111,700	17,300	3,200
1943–44....	43,100	8,000	1,700
Present Quota[1]	6,750	.....	.....

[1] Over 18 years of age.

April 1, may force a number of the colleges and universities to close simply because there won't be any students. Actually, the chemical engineering phase of ASTP was discontinued in 1943 since the armed forces had no further need for chemically-trained personnel.

It is obvious, therefore, that unless the basic policies of Selective Service are changed by the vociferous demands of industry, after the present emaciated class there will be only a negligible number of new chemical engineering graduates until the end of the war, nor will anything approaching a normal class be graduated until a minimum of three years after the war! Industry must reconcile itself to the fact that it will not be able to obtain any new engineering graduates no matter how acute the needs, for "that's all there is and there'll be no more." It's about as final as that.

22 AND UNDER

The present situation in regards to deferment of men under 22 seems to be full of confusion, although such should not be the case. This state of affairs has been caused by Selective Service amended Memorandum 115, effective February 1, 1944, which eliminates the deferment of all men between the ages of 18 and 22 except *in very special cases.*

Memorandum 115 requires that requests for occupational deferment for all registrants under 22 be made on a special 42-A form which must be endorsed by the state director of Selective Service and then returned to the local board for action. Soon after this directive was issued a considerable number of state directors gave out the definite impression that no person, regardless of requests for occupational deferment, would be exempted. At least one director, it is rumored, jumped the gun on official thinking and implied that he did not intend to recommend occupational deferment for any person in industry under 26 years of age. Just why the state directors should be so unanimous and simultaneous in their change of attitude on the question is somewhat of a mystery.

Naturally, the rumor that no deferments would be permitted in this age group spread like wild-fire, and considerable damage was done before it was checked. It

Table II—Overall Balance Sheet for Chemical Engineers [1]

Total graduates since 1921	29,000
Probably active in profession	25,000
In armed forces	
Experienced	500
Inexperienced	2,500
In industry, total	22,000
Under 22 years old	1,500
Under 26 years old	5,000
Probable needs of industry	26,000
Present accumulated shortage	4,000

[1] Approximated as of early 1944.

was even believed for a time in some quarters that the special provision for occupational deferment was never intended to be so applied. This is entirely erroneous.

Some individuals and even a few government war agencies have jumped to the conclusion that it would be better not to request deferment of these young men, to make "sacrificial goats" or "bargaining points" of them, so to speak, and thereby have a better chance of holding their older men. Still others are beginning to think that the expense and executive man-hours necessary to keep a young engineer for possibly only a few months are not justifiable. Such attitudes are not only shortsighted, but they actually damage the chances of deferment for some of the older men. If a man under 22 is not essential, who can defend the man of 23, or 24, or 25? Certainly industry would have little voice in determining just where the line should be drawn. In fact, considerable thought has already been given to upping the general no-deferment class to include men under 26, and this attitude will probably dominate official Selective Service thinking very soon.

REPLACEABILITY MYTH

Some individuals seem to doubt the essential importance of the young engineer in our war chemical and process industries. The chemical industry is geared almost completely toward contributing to the war effort, and probably at least 90-95 percent of all chemical engineers, most especially the younger men, can be legitimately classified as 2A or 2B. There may be considerable executive thinking and planning on postwar problems, but there are very few engineers actually doing work on such developments. In addition, the practical limit has just about been reached in "diluting" or "exploding" technical jobs. Make no mistake about it, the young chemical engineer is vital to our war effort, triply so because (1) the source of supply of engineers has now been cut off, (2) industry demands for these men are still increasing for expanding research and development programs and for enlarging and maintaining production facilities, (3) losses by industry are continuing and may soon be sharply accelerated.

The stage has now been reached that arguments about the "replaceability" of any chemical engineer doing essential work in an essential industry have lost all meaning. Taking the field as a whole, the replacement of one engineer by another is now merely a matter of robbing Peter to pay Paul. Production operations and technological developments are bound to suffer from such practices.

One executive of a large chemical concern which has already made outstanding contributions to our war effort put the situation somewhat as follows: ". . . we shall need additional technical men to maintain effective operations, but we have concluded that we are not going to get them and hence have keyed our thinking toward making every effort to do the best with what we have. We think the company's technical efforts are going to suffer, but such are the facts. We feel that it is a major mistake in judgment to curtail creative technical effort for the sake of a negligible number of additional service raw material in terms of the total armed services. This thinking is also predicated on the assumption that some personnel now in our war plants can be transferred to regular operations in the near future. If this does not materialize, we shall be in much worse shape." This concern, which has been recruiting technical personnel at the rate of more than 100 for each of the past four years, feels that its yearly requirements will continue to be in the neighborhood of five percent of its technical staff.

FIGHTING IDEAS

It is easy for men familiar with the situation to give generalities as to the war-importance of chemical engineers under 22 and under 26 now in our plants and development laboratories, but nothing short of specific examples and lots of them can impress Selective Service. Here are a few actual cases, gathered at random, of some of the fighting ideas and contributions of our young engineers under 26.

1. One chemical engineer was assigned at the age of 23 to set up production capacity for sulfa drugs in the pilot plant of a large concern. This man helped to rearrange pilot plant equipment and organize a production program to a point where the firm could supply the major portion of WPB requirements of these drugs without the erection of a new plant, which would have been time-consuming and costly in critical materials and labor. At least a million pounds of sulfa drugs, potentially equivalent to hundreds of thousands of soldiers' lives, have been turned out by this unit. This was an unusual assignment for such a young man, but no plant facilities and no production men were available for the job, a direct request by WPB.

2. A chemist under 26 years old has developed a catalyst which has given a much improved yield in the preparation of a new highly important and highly confidential plastic material for the armed forces.

3. One company which figures heavily in the program for producing dichlorodiphenyl-trichloro-ethane, the remarkable new insecticide developed for our troops and known as DDT, reports that its work on this material has been done largely by technical men under 26, and that close to 65 percent of all its pilot plant work on war developments has been done by men of the same age group.

4. Another concern has three men under 22 who occupy key positions in the production of anhydrous hydrofluoric acid, highly important in the aviation gasoline program. The average age of plant supervisors in this concern has declined from 27 to 23 years during the war period. This company needs 40 more chemical men for 100 percent war projects.

5. A Ph.D. chemical engineer was assigned immediately upon graduation in 1943 to a Chemical Warfare plant, where he has conducted process research on improving output, quality and yields from critical raw material and manpower requirements. This work has been successful in all of the above aspects and this particular engineer is responsible for a substantial portion of the success. Ordinarily, this man would not have been placed in such a responsible position without extensive pre-training, but no other person was available.

6. Although no overall figures are now available, the nation's penicillin program is largely dependent upon chemists, chemical engineers and other technical men under 26 years of age. A number are under 22. One of the largest producers of penicillin, for instance, is in imminent danger of losing a chemical engineer under 22, while another has three of its ten chemists under 22 on production of this drug.

7. One chemical engineer under 26 has contributed substantial creative developments in the preparation of a formula now being used for protecting clothing, army raincoats, ponchos and similar articles from chemical warfare gases.

8. Another, assigned to laboratory research for the National Defense Research Council within a few months after his graduation, did excellent work on the development of a process for making a new chemical badly needed in the war effort. After completion of the work, this man was transferred to the laboratory portion of a pilot plant investigation, assigned to the firm by the Chemical Warfare Service, where he is now doing an excellent job.

9. One leading firm has two chemists under 22 doing important work on antimalarial material being shipped to our troops in the tropics. A similar situation undoubtedly reaches back into all the corners of the industry, for at least 38 different chemicals are vital for the production of this one life-saving drug.

10. A large unit producing butadiene

for the synthetic rubber program has two of its twelve chemical engineers under 22 years of age and three additional ones under 28.

11. One of the country's largest producers of war plastics has approximately 40 percent of its technical personnel working on these materials under the age of 26.

12. Probably 10 percent of the chemical personnel in the synthetic rubber program is less than 22 years old, possibly 50 percent less than 26. The research and development phases of this program, employing a total of approximately 500 chemists, chemical engineers and physicists, will be greatly curtailed and possibly eliminated to a large extent if all personnel under 26 were lost to the armed forces (unless some government authority would assume the task of replacing them by robbing other industries). There are approximately 1,500 chemists and chemical engineers now located in all government-owned and private synthetic rubber plants, of which probably 950 are chemical engineers, according to the U. S. Bureau of Labor Statistics. These figures exclude personnel in research development outside the plants.

13. In all petroleum establishments, it is estimated that nearly six percent of all personnel vulnerable to Selective Service is under 23. Approximately 30 percent of the technical personnel in refining research now vulnerable to Selective Service call is 25 years of age or less and about 70 percent is less than 29. These figures are based on schedules filed for research laboratories of petroleum companies and do not include those for research carried on in the laboratories of petroleum refineries. The petroleum industry has a total of about 12,000 technical men, a large proportion of which is chemical and process engineers. The Bureau of Labor Statistics has estimated the following age classification breakdown for technical men in all petroleum establishments:

	Total Technical Personnel, Percent	Total Personnel Vulnerable to Selective Service, Percent
Less than 23..	3	6
Less than 24..	6	11
Less than 26..	8	..

14. One large chemical concern very heavily engaged in direct war work has a total technical personnel of 900, of which probably at least 400 are chemical engineers, including a research department of 325 technical graduates. The age breakdown of the group is as follows:

	Total Technical Personnel, Percent	Research Departments, Percent
18 through 21...	2	3
22 through 25...	25	30
26 through 30...	24	25
31 through 37...	22	42
Over 37........	27	

16. Of the 14,115 chemical engineers surveyed by the National Roster as of July 1, 1943, the median age was 26.8 years. The age breakdown of the entire group was as follows:

	Percent of Total
29 and under............	64
30 to 39..................	19
40 to 49..................	11
50 to 59..................	4
60 and over...............	2

If anyone seriously doubts the importance of the young chemical engineer in our present industrial war set-up, let him first talk to responsible persons in the synthetic rubber and aviation gasoline programs, the plastics and synthetic organic chemical fields before expressing his opinion publicly.

TWO REGIMENTS

Assume that the armed forces need these chemical engineers, not for technical reasons, which they do not, but for sheer manpower. What would they get? The estimated 1,500 chemical engineers under 22 *still in industry* (2,500 are already in service) would amount to some 0.013 percent of the total estimated armed forces as of July 1, 1944. If every chemical engineer under 26 still in industry were taken, the equivalent of about two regiments would be added to our men in uniform. Are two regiments of chemical engineers more important in the combat army, most likely as ordinary soldiers, or in industry serving the war effort as engineers?

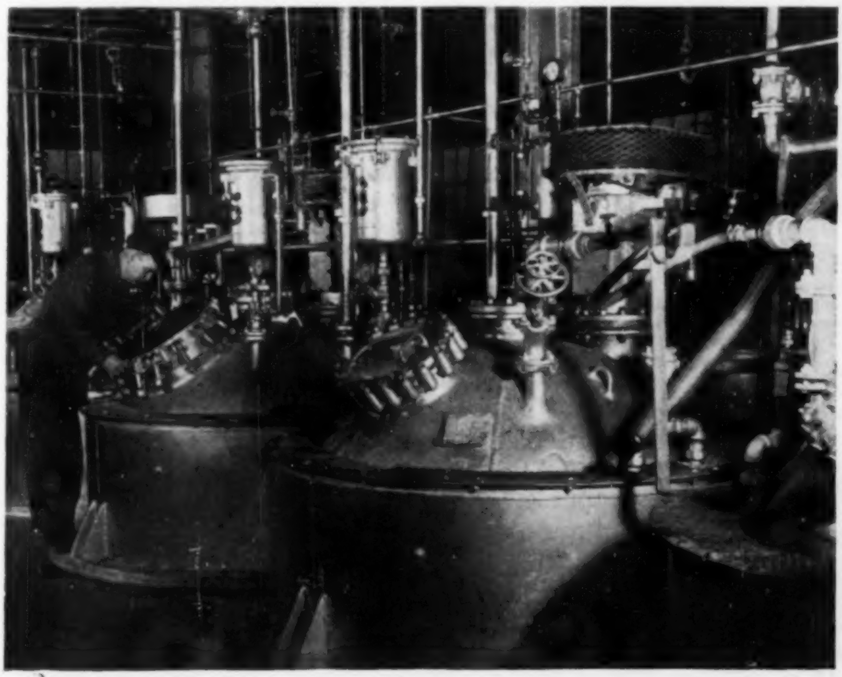
There is another statistical way of looking at the situation. There are about 3.5 times as many persons employed in non-agricultural activities as in agriculture itself. Of the total number of registrants deferred in agriculture, about 400,000 are single men under 22 years of age. Yet, in all war-producing and war-supporting activities, about 115,000 non-fathers below the age of 22 were deferred as of the first of this year. Of these, it is estimated that probably not more than 15,000 represent engineers of all types and about 1,500 represent chemical engineers alone. One of the reasons for this discrepancy, of course, lies in the fact that agriculture has been protected by law, whereas industry has found it necessary to shuffle for itself.

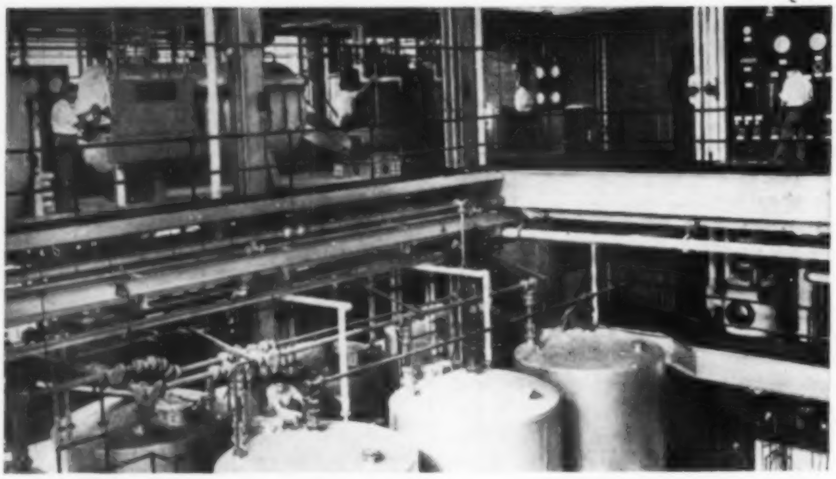
MENTAL OR MORAL

The basic argument, of course, behind this trend toward the squeezing from industry of badly needed non-father engineers under 22, and soon under 26, is that of the moral pressure put on Selective Service by those people who do not like to see fathers drafted before non-fathers, older men before youths, even though these youngsters may be contributing much more toward victory than many of those more mature in years. Yet, mentally, it is our duty always to remember that this war, of all wars in history, is a struggle of technologies rather than of moral pressures.

It is significant to note that of our allies, England and Canada and probably Russia and China, clearly recognize this fact. In all of these countries, and also in Germany at least until fairly recently, the pressure has been on keeping technically trained men in the ranks of the production army rather than absorbing them into the combat army, as may soon occur in this coun-

Probably half of the 1,500 chemical personnel now helping to turn out the nation's yearly needs of 850,000 tons of synthetic rubbers are under 26. Can we lose these men to the armed forces and have our rubber too?





In war as in peace, chemical engineers are vital to development work. This group is working in a pilot plant at the Northern Regional Laboratory

try, the most technologically advanced of all nations. All this tends to make one wonder if we in America are as bright as the rest of our allies, or even our enemies. Other factors, of course, enter into the situation, so that direct comparisons do not necessarily give an impartial picture.

Several definite conclusions can be drawn of the situation as it now exists: (1) the chemical and process industries are short of chemical engineers to maintain and increase production of essential materials and at the same time to keep war research and development at a high level; (2) industry cannot count on obtaining any additional chemical engineers for the duration of the conflict; (3) it will become increasingly difficult for industry to retain its non-father technical men under 26.

What can be done? There are several answers: (1) industry must plan on ways and means to maintain production and development activities at the highest possible level without any new technical personnel; (2) all chemical and other technical personnel sould see to it that they are located in the most essential industries and performing the most essential duties for which their training and experience entitle them; (3) industry must locate its engineers in those activities in which they are most neded for the war effort and then make a vigorous and determined effort to retain them in these activities, regardless of their age classification; (4) if certain plants or departments have any engineers, including those under 22 years old, who are not vitally needed or for whom claims for deferment will not be vigorously pressed, these men should immediately be released to those industries which are badly in need of them and which will fight to get and to keep them.

POSTWAR POSTULATES

Before predicting what will happen in the chemical engineering field in the postwar period, a hazardous thing to do under any circumstances, it will first be necessary to assume that certain trends will materialize, certain conditions be assured. The first of such assumptions, naturally, is the point that Mr. Baruch emphasized in his recent report: a depression is not a necessary corollary of the war. Certain readjustment pangs will be felt, but if the economic halter is used promptly and properly, there are no reasons to believe that a gradual and controlled reconversion cannot very well buffer the shock of sudden peace.

The initial postwar period, those first five years after the complete collapse of our enemies, will present serious problems to the chemical and process industries and hence to chemical engineers. Broadly speaking, there will probably develop two postwar worlds for chemical engineers—one for the young engineer and a different one, in general, for the older, more established men. The older man will, as a generality, be fairly well stabilized in the niche he has carved out for himself in the profession. In many cases, his will be merely an accelerated version of the prewar world. It will be the young chemical engineer who may lose his job, be forced suddenly to change his location, have his income drastically reduced, and bear the brunt of union pressures.

OUT ON A LIMB

At the end of the war, industry will find itself in a highly unsaturated condition insofar as chemical engineers are concerned because of losses to the combat army and practical elimination of the source of supply at the time that demands for war-expanded activities have been increasing. It is estimated roughly that this deficit will amount to the neighborhood of 4,000 chemical engineers. Such a war deficit, however, may have little meaning in the postwar because of the radical changes that will without doubt occur in the industrial set-up.

Confirmation of the war's end to a number of young chemical engineers will be the sudden and practically complete curtailment of all-war plants such as TNT, smokeless powder, CWS and other munitions. Fortunately there will not be so many chemical men involved, probably not in excess of 1,000. The well-trained and key men who had been transferred from other jobs by the operating companies will almost certainly be returned to their former positions. Actually, it is likely that all but possibly a few hundred of these munition engineers will be absorbed in other plants almost immediately.

Very soon after peace becomes final, a number of other industries such as those producing ammonia, alcohol, aviation fuels, chlorine, magnesium and similar products for which production facilities have been highly inflated, may make ex-

Taable III—Estimated Requirements of Engineers and Chemists for Synthetic Rubber Industry by Branch of Industry and Occupation [1]

Occupation	Number of Employees: All Plants	Butadiene	Styrene	Copolymer	Neoprene and Butyl
Chief engineer	27	19	8	...	...
Engineer [2]	406	298	62	28	78
Technical director	21	21	6	15	...
Total, engineers	514	323	85	28	78
Chief chemist	29	19	8	...	2
Chemist	136	20	82	...	34
Laboratory foreman (chemist)	107	47	22	29	9
Total, chemists	272	86	112	29	45
General foremen	168	64	46	41	17
Shift foremen	579	99	353	69	58
Total, foremen [4]	747	163	399	110	75
Total chemical engineers (est.)	943	372	343	101	127
Total, all chemical personnel	1,533	572	596	167	198

[1] From schedules filed with the U. S. Bureau of Labor Statistics for synthetic rubber plants during the latter part of 1943.
[2] Includes general management personnel who are clearly chemical engineers. Of the total engineers listed here, approximatly 15 percent are not chemical engineers.
[3] Includes 23 departmental superintendents.
[4] Of the total foremen listed, 147 (copolymer 73, butadiene 30, styrene 10, Butyl and Neoprene 34) were known to be chemical engineers; probably 400 of the remaining 600 are chemical engineers.

tensive revisions in their production schedules, at least until the market situation for these commodities becomes clarified. Petroleum refining, for instance, will probably revert to a large extent to the production of improved pre-war automobile fuels. It is unlikely that this industry, now the largest or second largest employer of chemical engineers, will release any substantial numbers of its technical personnel. Unfortunately, this situation may not hold true for those plants producing such chemicals as nitric acid and chlorine for which vast new markets must be developed to absorb the surplus.

Reduced operations all along the chemical front during the initial readjustment phase will necessarily cause a reshuffling of considerable technical operating personnel. It can be expected that intercommodity competition will increase sharply among most chemicals, and efforts to develop new markets and outlets will be intensified. Such a trend will eventually absorb a considerable number of engineers back into develpoment work, largely curtailed during the war in favor of increased production and war research. Short-term prospects thus indicate a considerable reshifting of chemical personnel after the war, but there is little likelihood that the chemical engineers in industry at the end of the war will be without jobs for more than a brief period of time.

THE ARMY RETURNS

What about the 3,000 or more chemical engineers that will be in the armed forces? Presumably, these men will be demobilized over a period of a year or two so that at least industry will not be deluged as was the case in World War I. Probably about 500 are experienced engineers that went in as reserve officers. Even though many of these chemical officers may not return for some time after the peace, most of them will find their former jobs in industry waiting for them. They will have little difficulty in making up for lost time by advancing in their organizations.

More serious problems will be posed by the return of the inexperienced engineers, the men who went in to the service directly from the universities. War experiences will help to develop these as leaders of men, but unfortunately not as chemical engineers. The men in this class that return soon after the peace may find competition for jobs from the returning experienced engineers as well as from those young engineers who remained in industry and who, about that time, will be in the process of being absorbed from direct war work into regular operations. The men who return latest may encounter increasing competition from large and fresh batches of postwar graduates. Of course the fact that the returnees are ex-service men will tend to neutralize these disadvantages to a considerable degree.

Most representatives of industry emphasize the fact that they are perfectly willing to absorb these inexperienced ex-service engineers by placing them in plant operations for a "refresher" period, after which they can advance in the usual manner. This retraining-in-industry phase will ary according to the individual's abilities and "remembrance of things past" learned.

The ideal place, of course, for the higher caliber men would be back in the graduate departments of our engineering schools, for there will be a stimulating demand for postgraduate engineers, a casualty of the war on education. Something more concrete than logical persuasion, however, will be necessary to persuade many of these men to resume their studies. The answer probably lies in providing graduate fellowships and grants from industry and government.

Thus, while industry's immediate postwar capacity to absorb all engineers dumped from war plants and the services may cause some initial difficulty, there is little question that the long-term outlook is bright. The prospects from this viewpoint are very well discussed in a special report to engineers in the services which appeared in this February's issue of *Chem. & Met.* Table V outlines the potential opportunities in some of the process industries, both old and new, such as food processing, plastics, air conditioning, synthetic textiles and instrumentation, all of which are rapidly becoming more conscious of the potentialities of applied chemical engineering.

Within the first postwar decade there will be golden opportunities for engineers to be absorbed simply by means of a more thorough penetration both vertically and horizontally in the chemical and especially the process industries. Diversification of activities from the more strictly engineering occupations such as equipment design, plant operations and development work, into technical sales and service, management, labor relations, safety engineering, packaging and shipping, market development and chemical economics can easily sponge up all available engineers for years to come. Actual materialization of these opportunities will depend to a large extent, naturally, upon the ability of engineers to sell themselves into such services.

Out of this war of technologies there will emerge a new vast horde of semi-skilled men and women, an army of technicians such as the country has never before seen. Industry's acute needs, accentuated by a shortage of professional personnel, is creating large numbers of over-accelerated and therefore undertrained engineers, "quickie" course graduates, women technicians who responded to the call of industry, sub-standard graduates who ordinarily would have been squeezed out of the profession by a healthy competition, up-graded industry trainees, army "special course" students, personnel graduated into technicians by special union edict, and other "90-day wonders." Industry has used these technicians to great advantage, and their numerous contributions have made possible our coming victory. Nevertheless, after the war's end what will happen to these "in-betweens," these creations of a technological struggle that deserve more consideration than skilled workers and yet cannot quite make the grade into a profession?

TECHNICIANS GALORE

To elevate all these technicians to the professional level would tend to dilute the profession to the extent that it would soon become a mockery to technical and professional men alike. To push them back into low-prestige jobs would not only be a grave injustice to the technicians themselves but would provide unquenchable fuel to the fires of unionism.

One possible answer: we have created a class of technicians, now we must retain it as a class and endow it with a dignity and prestige all its own. Industry, from war necessity, has learned that it can profitably use large numbers of such persons, reserving its professional personnel for work requiring more initiative and creativeness.

The public, as never before, has become conscious of the value of a technical education. One canvass of nearly 400 trainees in a military training program found that

Union leaders will work overtime to capitalize on this drop in green engineers' postwar incomes

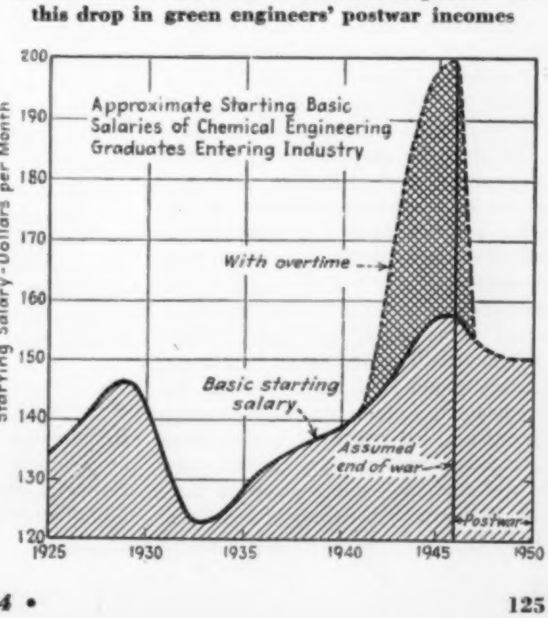


Table IV—How Chemical Engineers Can Be Absorbed in the Postwar Industrial Set-Up

Activity	Present Relative Absorption[1]	Postwar Absorptive Capacity[1]
Slightly Saturated		
Industrial management	S	M
Technical service	S	L
Equipment sales	M	L
Product sales	S	L
Public relations	S	S
Labor relations	S	S
Market development	S	M
Safety engineering	S	M
Packaging development	S	M
Foreign rehabilitation	S	M
South American development	S	M
Advertising	S	S
Process improvement	M	L
Postgraduate study	S	M
Traffic and shipping	S	S
Instrumentation	S	M
Moderately Saturated		
Production supervision	L	L
Plant maintenance	M	M
Plant construction	M	S
Pilot plant operation	L	L
Personnel problems	S	S
Industrial fellowships	S	M
Consulting	M	M
Literature & patent searching	S	S
Chemical economics	S	S
Largely Saturated		
Equipment design	L	M
Laboratory research	S	S
Federal government	M	S
College teaching	M	S
Finance	S	S
Armed forces (CWS)	M	S
Patent developments	S	S
Municipal & State governments	S	S
Jobbers & representatives	S	S
Independent manufacturing	S	S

[1] These columns are intended to indicate very roughly the estimated present absorption of engineers according to activity classifications and the visualized capacity of these activities to absorb additional chemical engineers in the postwar period after the initial readjustment phase. The letters indicate relative numbers of engineers, as follows: S = small, M = medium, L = large.

nearly half planned to go to college after the war and that more than 80 percent of these wanted to study engineering. This is just one instance of how the spectacular achievements of engineering and science in the war have captured the imagination of young men. Yet, it is very likely that most of these students are uninformed as to the exact distinction between vocational and professional training. Many of them will visualize themselves doing the work of a technician when they enroll without realizing the difference between the work of the technician and that of the engineer.

The inevitable result of trying to attain a profession for which they are not suited will be disappointment, failure and the stigma attached to having missed one's goal. Yet, even in the past, only about 40 percent of our freshmen engineering students have succeeded in securing their degrees at the end of four years. Possibly a solution could be worked out by stressing the fact, found by a study made by the Society for the Promotion of Engineering Education, that industry needs about three technicians for every college graduate and that the earning power of these men, as shown by the study of a group of 1,000 two-year technical graduates, is within five percent of a large group of four-year college graduates. If industry and our schools should refuse to define and give the proper recognition to these technicians as a class, it is certain that the unions would do so, with full and vengeful success.

If such should happen, then our professional men, especially the inexperienced and young engineers, may suddenly find themselves sucked in and absorbed by this large group of technicians, either through sheer moral pressure or by Goebbelsian glibness on the part of certain outside labor unions. The engineer will then lose all his identity as a professional man. All his freedom of action and decision, his responsibilities for which he has groomed and conditioned himself and worked so hard to attain, will vanish completely.

Make no mistake about it, the unions will have powerful arguments to present to the young engineers, especially to those men who, for one reason or another, do not or cannot advance fairly rapidly. The monthly earnings of the engineering graduate just entering industry will drop from the present bloated average of about $200 to $210 a month for the first year to about $150 a month. Some unionized technicians are now receiving a starting salary of $145–200 a month. The unionized man is fairly well assured that his salary will not drop too drastically, so that it may not be uncommon for the sub-professional worker to be at a higher income level than many young engineers. Such realities may tend to blunt the edge of arguments about long-range career and professionalism insofar as the young individual engineer is concerned.

BY THE HORNS

That the threat of outside unionization to the professional worker has now been fully recognized is proved by the recent action of the American Society of Civil Engineers. This organization has appropriated $50,000 to engage four full-time regional field representatives to sponsor local collective bargaining agencies of professional engineers, under A.S.C.E. auspices, in areas where the Society has local sections. Officers of this organization have become convinced that many qualified engineers have already been faced with the unpleasant choice of joining an existing union or of losing opportunities for desirable jobs. The only alternative for many professional engineers, so argue A.S.C.E. officials, is to organize with their professional fellows and to choose members from the group thus formed to bargain in their behalf. The Society takes the view that the situation has already become too critical to await national or state legislative correctives. The outcome of this bold and unorthodox move will certainly be watched with interest by all professional men throughout the country.

Reprints of this report are available at 25 cents per copy. Address the Editorial Department, *Chem & Met.*, 330 West 42nd St., New York 18, N. Y.

Table V—Where Chemical Engineers Can Be Absorbed in the Postwar Industrial Set-Up

Industry	Present Relative Absorption[1]	Postwar Absorbing Capacity[1]
Petroleum refining	L	M
Food processing	S	M
Synthetic rubber processing	L	M
Plastics	M	L
Air conditioning	S	M
Aviation	S	M
Synthetic textile fibers	M	L
Light metals	M	M
Synthetic pharmaceuticals	S	M
Liquid fuels from coal	S	M
Synthetic organic chemicals, misc.	L	L
Agricultural chemicals	S	M
Glass and ceramics	M	M
Chemurgy	S	M
Industrial waste utilization	S	S
Smokeless fuels	S	S
Protective coatings	M	M
Solvents	M	M
Packaging	S	S
Pulp & paper	M	M
Heavy inorganic chemicals	L	L
Leather & leather substitutes	S	M
Control instruments	S	M
Lime & cement	S	S
Pigments & dyes	M	M
Industrial explosives	S	S
Perfumes & cosmetics	S	S
Equipment design & manufacture	L	M
Soaps & detergents	M	M
Fats & oils	S	M

[1] These columns are intended to indicate very roughly the estimated present absorption of engineers according to industry classifications and the visualized capacity of these industries to absorb additional chemical engineers in the postwar period after the initial readjustment phase. The letters indicate relative numbers of engineers, as follows: S = small, M = medium, L = large.

Just recently the American Institute of Electrical Engineers authorized the appointment of a committee to study broadly the whole subject of employment of electrical engineers, including security and employment, compensation and collective bargaining. Similar investigations are being made by a number of other groups. Obviously, if results of these studies show that engineers should organize as a body, then they should certainly provide the strongest kind of an organization possible.

A little prophecy is a dangerous thing, but the editor of this report still dares to predict that the chief postwar difficulties of the chemical engineer, especially the young man, will lie more in threats to his professional standing from outside union and social forces than in any problem of getting located in his preferred work in industry. Until a general solution is found, the engineer's only answer to such outside threats will be to hold even more steadfastly to all the ideals and ethics of his profession, the code of the man who serves unselfishly.

PROCESS EQUIPMENT NEWS

THEODORE R. OLIVE, Associate Editor

PIPE LINING MATERIAL

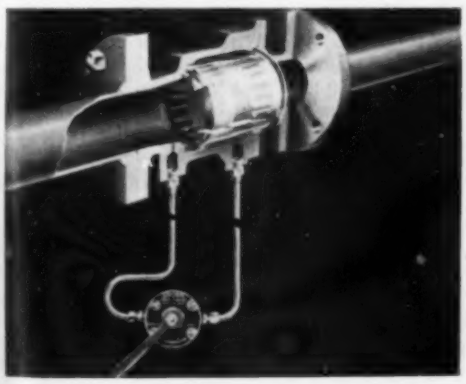
INTERNAL insulation permitting the use of carbon steel pipe of ordinary weight and construction for the handling of high temperature fluids such as petroleum gases, superheated steam and mixed vapors at temperatures as high as 1,000 to 1,500 deg. F., has been developed by Baldwin-Hill Co., Trenton, N. J. Known as Insidline, the new construction consists of a layer of high temperature insulating material placed against the inner surface of the pressure piping, retained and protected by metal liners so arranged as to provide adequate expansion clearances, with the minimum of heat flow through the metal. The inner liner is not required to resist pressure and therefore is not made pressure tight. The insulating material is a felted block with a diatomaceous earth base reinforced with amosite asbestos fibers. The composition and thickness of the inner liner can be varied to meet conditions of temperature, corrosion, erosion and velocity encountered in various installations.

The primary objective of this new construction is to hold the temperature of the pressure piping to 650 deg. F. or below and so prevent creep under usual stress allowances. An incidental advantage is heat saving, together with simplification of the design of the piping through reduction in the number of expansion joints and other provisions for pipe expansion.

Insidline applications have been made for flue gases, steam, petroleum gases, hydrogen and fluid catalysts, for pressures up to 300 lb., at temperatures to 1,500 deg. F. in various combinations. Such linings have been placed in pipes ranging in size from 2 in. up to 100 in. diameter and single lengths up to 60 ft.

Applying lining to inside-lined steel pipe

Flexflo remote-control valve



REMOTE-CONTROL VALVE

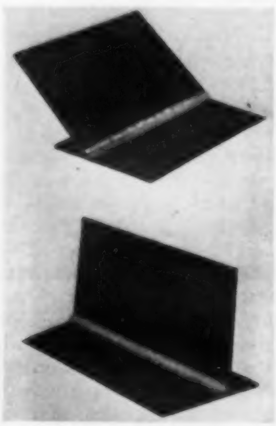
NEW IN PRINCIPLE, the Flexflo remote-control valve shown in an accompanying illustration has been developed and introduced by the Grove Regulator Co., 6527 Green St., Oakland 8, Calif. The new valve operates by manual or automatic remote control, employing the pressure of the fluid handled to open or close its ports. Since virtually no external force is required, even a large 24-in. valve can be opened or closed as readily as 1½-in. valve, according to the manufacturer.

The valve is intended for cold fluid service, for handling water, salt water, chemical solutions, oils, gases and air. Owing to the fact that only one non-metallic operating part is employed, the valve is claimed to be extremely resistant to corrosion and erosion, as well as to electrolytic action. Furthermore, it is self-compensating for wear. Capacity is said to be considerably greater than that of a globe type valve of the same pressure drop.

Construction is illustrated in the cutaway view. The valve consists of a body within which is a slotted pipe-like core containing a solid barrier at its center. A resilient tube of some material such as rubber or synthetic rubber is slipped over the core. Outside the resilient tube is a control chamber which can be connected by means of the small three-way control valve shown beneath the main valve, either to the upstream pressure or to the atmosphere. In operation, when the upstream pressure is applied to the control chamber outside the tube, thus balancing the pressure on both sides, the valve seats tight. When the three-way control valve handle is turned to disconnect the upstream pressure from the control chamber and vent the latter to the atmosphere, the unbalanced pressure inside the tube distends it and causes the valve to open wide.

Since the valve employs no seat, disks, springs or weights and has no packing gland, stuffing box or exposed members, it is said to be very simple to maintain and to require no more headroom than a pipe. It can be controlled from a central remote-control station if desired, and can be operated hydraulically or pneumatically by various systems.

Typical welds with new electrode



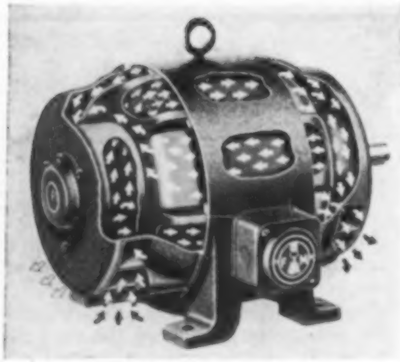
GENERAL-PURPOSE ELECTRODE

FOR THE ARC welding of mild steel in all positions, with either alternating or direct current, the Lincoln Electric Co., Cleveland, Ohio, has developed Fleetweld 37, a new general-purpose electrode. The electrode is said to operate with absolutely no slag interference when welding vertical down, the fastest position for 8- to 16-gage steel. The electrode permits higher welding speeds since it is capable of withstanding higher currents, both alternating and direct. With the proper current it is claimed neither to stick to the work nor to burn through. Tests on welds so produced are said to have shown tensile strengths from 70- to 80,000 lb. per sq.in., yields strengths from 60- to 68,000 lb. per sq. in. and ductility of 18 to 25 percent.

ULTRA VIOLET PHOTOMETER

AN ULTRA VIOLET photometer, developed by engineers and scientists of E. I. du Pont de Nemours & Co., primarily for the detection of low concentration of carbon disulphide vapors in air, is expected also to be suitable for the detection of dangerous concentrations of other gases and vapors. According to present plans, instruments of this general type will be manufactured by the Mine Safety Appliances Co., Pittsburgh, Pa. The new instrument is much faster and simpler than analyzers previously used and is so sensitive that it can detect one part of CS_2 in 1,000,000 parts of air. Giving instantaneous readings, it is capable of operating on continuous samples.

Operation of the photometer is based on light absorption by gases. Most gases, including the constituents of the air itself, absorb light of some particular wavelength, in effect casting a shadow where that particular wavelength of light would otherwise have fallen. Carbon disulphide, for example, strongly absorbs light of 3,132 angstrom units wavelength. Therefore, the



Protected squirrel-cage motor

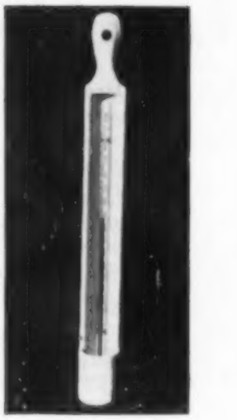
carbon disulphide analyzer is operated on ultra-violet light from a mercury lamp and is provided with an optical system, including filters, so selected that about 60 percent of the photometric response of the electric eye is due to light of this wave-length. Air to be analyzed is pumped through several small chambers in the analyzer which filter out dust, oil and moisture, and then into a pair of parallel tubes about 31 in. long. Contaminated air flows through the first tube and then through a canister of activated charcoal which removes the CS_2 and returns the purified air into the second tube. In this way a continuous comparison of the purified and contaminated air is made, one part of vapor in 1,000,000 parts of air producing an absorption of 0.02 percent, which is detectible by the instrument.

PROTECTED MOTOR

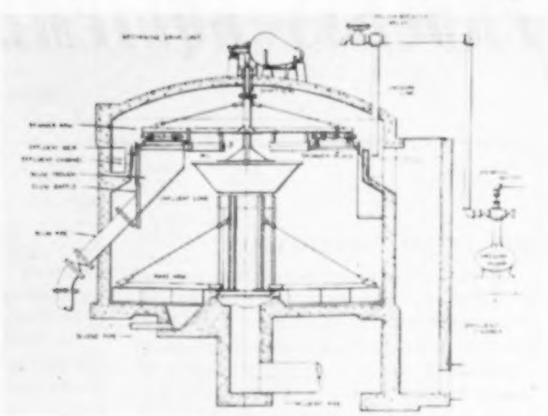
For use in all kinds of industries, a new type all-purpose, continuous-duty, polyphase squirrel-cage induction motor has recently been* announced by Fairbanks, Morse & Co., 600 South Michigan Ave., Chicago, Ill. The motor is said to be fully protected against flying particles and dripping liquids as well as other industrial motor hazards. It employs this company's recently developed centrifugally cast Copper-spun rotor and is equipped with ball bearings sealed in cartridge-type housings. Cross-flow ventilation is obtained through protected inlets and exhausts at the ends of the motor, designed to assure uniform cooling and the elimination of hot spots. The new construction is available in frame sizes from 224 to 365, inclusive. Among the special features may be mentioned the fact that the frame is cast in one piece with rib sections to give added strength without increase in weight. Another new feature is an innovation in the conduit box. Where space is limited, the conduit can be brought up between the motor feet to a tapped hole in the motor frame and the conduit box cover assembled flush with the frame, thus eliminating the external box.

PORCELAIN-FRAME THERMOMETER

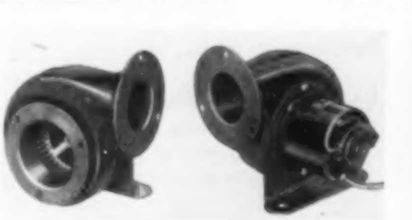
To sidestep the difficulty of securing metals, the H-B Instrument Co., 2502 North Broad St., Philadelphia 32, Pa., has developed a porcelain-frame thermometer which is used chiefly in the petroleum field



Porcelain-frame thermometer



Cross section of constant-level Dorrco Vacuator



Flexible-mounting blower

for determining the temperature of liquids in tank cars and other containers. As shown in the accompanying illustration, the frame, handle and cup are all in one piece. The thermometer tube is attached to the frame with two Monel metal bands. Units are available in a range of 0 to 160 deg. F., with a red-liquid-filled thermometer, graduated in single degrees, but other ranges can easily be made up to a top limit of 700 deg. F. or even higher, if necessary. Advantages for the new design include reduction in number of parts from 14 to4, and an increase in weight from 4 oz. to 1 lb., permitting the thermometer to sink freely in viscous liquids.

MOTOR-DRIVEN BLOWER

Developed especially for building into machines is a new all-purpose blower designated as Model No. 6S Utility Blower, which is being manufactured by the Ilg Electric Ventilating Co., 2850 North Crawford Ave., Chicago 41, Ill. As appears from the accompanying illustration, the housing and stand of the new blower are made of die-stamped steel, power being supplied by a series-wound, 110-volt, single-phase, 60-cycle motor operating at 3,400 r.p.m. Various arrangements are available including different combinations of blower, stand, and inlet and discharge flanges.

LOCK-ON SHEAVE

Quick and easy mounting and demounting are features of the new Magic-Grip sheave which has recently been announced by Allis-Chalmers Mfg. Co., Milwaukee, Wis. The sheave employs a tapered split bushing which slides almost all the way into the tapered bore of the sheave without forcing. A slight clearance is left between the bushing collar and the sheave hub. Tightening of hollow headed cap screws draws the bushing deeper into the tapered bore, compressing the split sleeve and

Removing Magic-Grip sheave

locking the entire sheave uniformly to the shaft. Torque is transmitted through keys. Removal is accomplished by employing two of the cap screws as jack screws which are inserted into tapped holes in the bushing collar and turned, separating the bushing from the sheave. The bushing then regains its natural expansion and automatically breaks its grip on the shaft.

VACUUM FLOTATION UNIT

Developed primarily for the removal of grease and light, difficult-to-settle solids from sewage and trade wastes prior to clarification, a new unit known as the Dorrco Vacuator which has recently been introduced by the Dorr Co., 570 Lexington Ave., New York 22, N. Y. When a trade waste is aerated, the largest air bubbles rise rapidly and escape to the atmosphere, while the finer bubbles are released slowly at ordinary pressures. When a vacuum is applied immediately after the escape of the large bubbles, the minute bubbles are released rapidly and attach themselves to light, suspended solid particles, carrying them to the surface. This principle is applied in the new equipment for the separation of grease, scum and light solids in handling sewage, as well as industrial wastes such as those produced in tanneries, gelatin plants and oil refineries.

The Vacuator accomplishes the action described in three steps, the first two taking place outside the Vacuator tank proper. The first step is aeration in a mechanical aerator. Deaeration then takes place in a small compartment or connecting channel where the larger air bubbles are re-

leased. Finally, the light-solids fraction is floated and removed in the Vacuator itself. Sometimes, where sufficient entrained gases are present in the feed, pre-aeration is unnecessary.

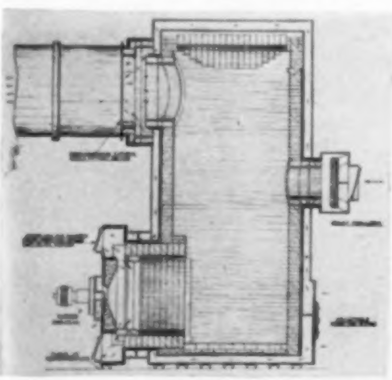
The equipment consists of a cylindrical tank with a dome-shaped cover in which a constant vacuum of about 9 in. Hg is maintained. The feed enters through a central draft tube and is distributed radially close to the liquor surface. Floated solids, buoyed up by the fine air bubbles, are continuously removed from the surface by means of a skimmer mechanism having hinged blades which push the light solid matter up a ramp and into a trough at one point in their rotation around the periphery of the tank. The grease or scum drops to a barometric leg for continuous discharge, while the clean effluent passes under a circular baffle and discharges over a weir into a peripheral channel from which it flows to a sealed chamber and discharges through a barometric leg. Coarse solid particles which settle are raked to a central sludge outlet which is also sealed off to prevent loss of vacuum.

At present the equipment is available in sizes ranging from 10 to 60 ft. in diameter and in two types, the constant-level type described here, and a variable-level type intended particularly for separation of floating material which is extremely light and cannot readily be raked up a ramp.

HOT-GAS FURNACE

For the production of hot gases for heating spray towers and dryers, Air Devices, Inc., 17 East 42nd St., New York 17, N. Y., has developed the Agitair furnace which delivers a hot gas consisting of a mixture of products of combustion and air or recirculated gases at discharge temperatures up to 1,700 deg. F. The furnace is oil or gas fired and may be used, according to the manufacturer, for the processing of all types of materials not affected by contact with hot combustion gases. The furnace consists of an air-jacketed combustion chamber provided with a draft regulator. Adjustable fresh-air intake dampers control the amount of air admitted into the air jacket, and this air, after taking up heat radiated from the inner furnace shell, mixes with the outgoing combustion gases. Control of the furnace is fully automatic, with constant discharge temperature maintained by modulating controls and a reversing type burner control motor. The furnace can operate at rates down to 25 percent of full capacity, according to the manufacturer, without producing smoke or odor, except the odor due to sulphur in the fuel.

Agitair hot gas generating furnace



New corrosion resisting motor

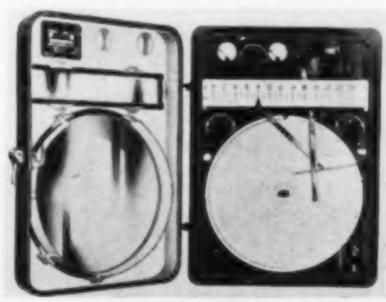
SEALED MOTOR

For use in atmospheres containing corrosive gases and vapors, or abrasive dust, as well as excessive moisture, the Crocker-Wheeler Division of the Joshua Hendy Iron Works, Ampere, N. J., has developed the Sealedpower corrosion-resistant motor which is built in sizes from 1 to 15 hp., for operation on any polyphase power supply. The new motor is totally inclosed and fan cooled but has no cooling ducts to collect wet or sticky dust. All exposed parts are said to be highly resistant to acid and alkaline conditions. In addition to mechanical sealing of the entire motor, each coil is individually sealed against moisture, fumes, vapor and dust by a vacuum impregnation process.

SELF-BALANCING POTENTIOMETER

Redesign of its Pyromaster self-balancing potentiometer has been announced by The Bristol Co., Waterbury 91, Conn. The new model 431 instrument has a universal wall or flush mounting case, considerably deeper than the previous model, and an internal hinged panel on which are mounted the pen, indicator drive mechanism and control mechanism. This arrangement makes possible servicing and replacing of any part without disturbing other parts, and permits including control relays in electric type instruments within the instrument case, thus eliminating considerable external wiring. The instrument is available in both electric control and pneumatic control types, employing the same basic principle as previous models of the Pyromaster, which required no continually moving mechanical elements and were said to be unaffected by vibration.

Improved Pyromaster recorder controller



Cleanable flat-spray nozzle

FLAT-SPRAY NOZZLE

A special feature which permits cleaning of the orifice during operation has been incorporated in a new flat-spray nozzle recently put on the market by Spraying Systems Co., 4023 West Lake St., Chicago 24, Ill. This nozzle employs a long-wearing hardened steel orifice and is provided with a clean-out needle which makes it unnecessary to cease operation for cleaning. Various capacities and spray angles are available, while the nozzle may be built of many materials besides steel, if desired.

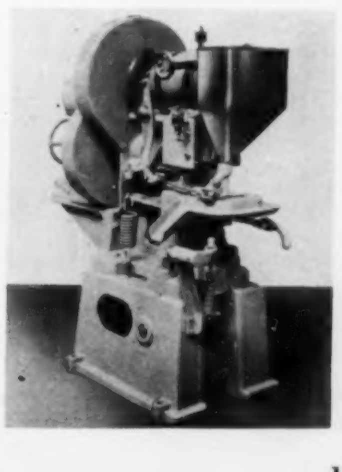
HIGH CAPACITY PRESS

Model T-4 is the designation of a new high-capacity press for ceramics and powder metallurgy recently designed by F. J. Stokes Machine Co., Tabor Road, Olney P. O., Philadelphia 20, Pa. Pieces up to 2¼ in. in diameter with a die-fill of 1⅛ in. are compressed by this machine at rates of 20 to 60 per minute. Pressures up to 12 tons are applied from both top and bottom and pressure adjustments may be made while the machine is in operation. The new press includes such features as separate ejection and compression levers; screw adjustments for compression; independent ejection cam; special clutch and combined brake which starts and stops the machine instantly, even under full compression load; variable speed drive; and adjustable gibs to maintain close accuracy in punch and die alignment.

MANUAL CONTROL VALVE

Designated as Type 461M, a new manual control valve for all liquids, gases and for steam service, has been announced by the Fisher Governor Co., Fisher Building, Marshalltown, Iowa. The valve is intended for throttling control on installations where high pressure drop or other

Type T-4 high capacity press



severe conditions are encountered and has been designed primarily for refinery service for handling residual oils with coking properties, or for pressure breakdown from reaction chambers.

The valve body construction employs a single-seated, plug-type inner valve which is sleeve guided, and a streamlined body contour to ensure low head loss and minimize possibility of deposition of solids within the valve structure. The inner valve, sleeve guide and seat ring are of hardened stainless steel, the valve being chrome plated. A connection is provided to permit flushing the inner valve sleeve guide with a clean flushing oil to prevent coke formation and insure free movement of the inner valve member. The heavy manual operating mechanism is spiral geared for ease in operation. A special indicator plate provides for accurate valve positioning. The valve is easily converted to automatic diaphragm motor operation while retaining possibility for manual positioning of the inner valve, if necessary.

VACUUM SWITCHES

SUITABILITY for use in hazardous locations where fire and explosion are a constant risk is an important characteristic of four new vacuum switches recently announced by the Tube Division of General Electric Co.'s Electronics Department, Schenectady, N. Y. Mounting the contacts in a vacuum makes the switches relatively free from corrosion and arcing and frees them from the effects of dirt and oxidation. Vacuum construction also permits these switches to handle additional current for their size. Three of the four types are rated at 8, and one at 10 amp., at 250 volts a.c. Motion is transmitted to the contacts through a flexible diaphragm which seals the tube interior from the atmosphere and at the same time acts as a natural fulcrum point for the operating arm.

ROTARY PUMP IMPROVEMENTS

SEVERAL new developments have been introduced into the line of rotary pumps manufactured by the Blackmer Pump Co., Grand Rapids, Mich. Several of these developments have occurred in marine-type pumps which are believed to have industrial applications. One is a new pump with built-in relief valve for lubricating oil handling which has a capacity of 50 g.p.m. at a discharge pressure of 20 lb. per sq.in., and is operated by a direct-connected 3-hp. motor at 870 r.p.m. The motor is supported by a bracket made of welded steel plate which, in marine use, is bolted to a bulkhead. The pump is mounted vertically on the base of the bracket, permitting free access for lubrication and adjustment. Another marine type pump having a capacity of 100 g.p.m. at 100 lb. pressure, powered by a 15-hp. gearhead motor, is mounted on a fabricated steel base designed to permit free access for lubrication and other service operations. A twin pumping unit having pumps of 90 g.p.m. capacity each, at pressures up to 100 lb., uses a single motor drive, connected to the two pumps through reduction gearing and twin clutches so that the pumps may be operated singly or together. Designed primarily for petroleum

Arco Microknife for film testing

blending operations, the pump provides double capacity to take care of temporary peak requirements or permit handling two different liquids simultaneously without contamination.

EQUIPMENT BRIEFS

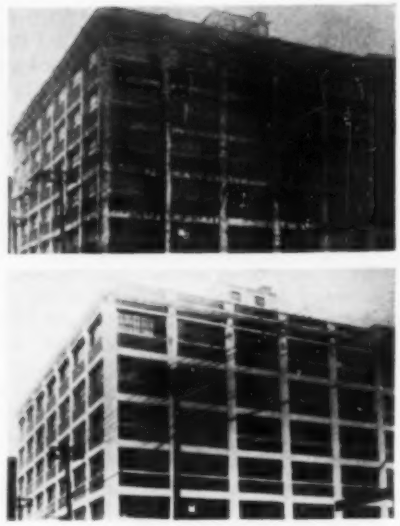
DEVELOPED by Battelle Memorial Institute at Columbus, Ohio, a new silver babbitt said to have the same bondability and corrosion resistance as tin-based babbitt, and to retain its hardness at operating temperatures without squeezing out of the bearing, has been announced by National Bearing Metal Corp., St. Louis, Mo. Silver alloyed with a properly balanced lead-base babbitt is employed as a means of circumventing the shortage of tin.

EXTENSION of its line of explosion-proof laboratory equipment, to include electrically heated temperature control cabinets and constant temperature baths, has been announced by Precision Scientific Co., 1750 North Sheffield Ave., Chicago 47, Ill. Wiring is inclosed in vapor-tight explosion-proof conduit fittings and electrical controls are mounted in explosion-proof housings to conform with Class 1, Group D hazardous-location requirements. Heating elements operate at low wattage density and at black heat to minimize temperature differential between the air and the heater surface.

ACCURACY of plus or minus 1 percent of full scale deflection up to 5,000 r.p.m. is claimed for a new electric tachometer announced by the Ideal Commutator Dresser Co., 1344 Park Ave., Sycamore, Ill. The instrument, which may be used either as a hand or as a separable type, consists essentially of a small generator and an electric meter. A switch is provided to give a high and a low range. Since the meter and generator are separable, connected together by a bayonet lock, they may be separated and wired to each other by several hundred feet of two-conductor wire for separate mounting of the two parts.

PAINT FILM TESTERS

DEVELOPMENT of two new machines for controlled testing, measurement and evaluation of the flexibility, scratch hardness and adhesion of paints and other coatings has been announced by the Arco Co., Cleveland, Ohio, manufacturers of industrial and other finishes. Test measure-

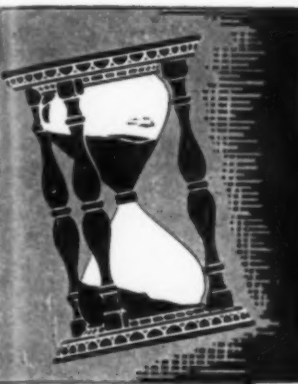


New Masonry Treatment

The two views above show before-and-after appearance of a brick and concrete factory building which has been treated with Waterfoil, a new product of the A. C. Horn Co., 43-36 Tenth St., Long Island City 1, N. Y. This product is manufactured from irreversible inorganic gels which, when applied to concrete, brick or stucco surfaces, reacts chemically with the lime in the masonry to form a heavy coating which is said literally to "weld" itself to the structure. The resulting coating is said to permit the masonry to "breathe," an essential quality, but to impede the absorption of water in liquid form, thus inhibiting the rusting of steel reinforcing bars. The new material is said not only to restore masonry surfaces and keep up appearances but to increase the life expectancy of the structure.

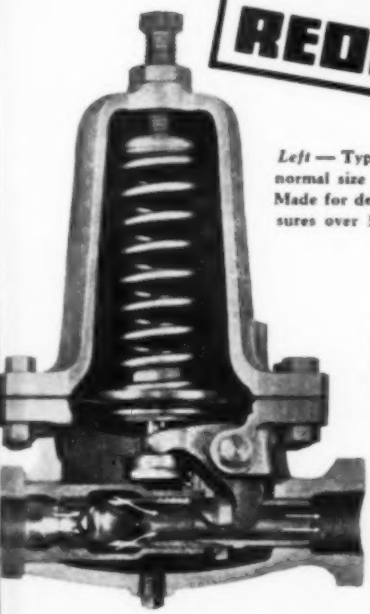
ments of flexibility are made on a machine known as the Arco Elongauge. This machine has been developed around a conventional Erichson sheet metal testing machine which was adapted to provide automatic control and accurate measurement for cycle testing. Mounted with the observation well in a vertical position, the machine permits water from a hypodermic syringe to contact the paint film being tested. The steel of the test panel and the copper of the hypodermic needle are connected to a galvanometer. A constant speed drive geared to thrust a spindle against the back of the test panel distorts the panel until the insulating paint film fails. When water contacts the metal of the panel, the bimetal of steel and copper causes an instantly detected current flow. Thus the exact elongation at which film failure takes place is detected.

For measurement of scratch hardness and adhesion, the company has developed the Arco Microknife. This consists of a diamond point cutting tool which is applied to the surface being tested under a measurable load as the point moves across the surface at constant speed and cuts repeatedly in a fixed position until the subsurface is revealed. The load and number of strokes required to wear through the film are the measure of scratch hardness. The same machine is used for adhesion measurements by lateral adjustment of the movable sample carrying platform. A standard stress is applied at progressively smaller spacings of the cuts until the stress is sufficient to displace the coating in the area between cuts.

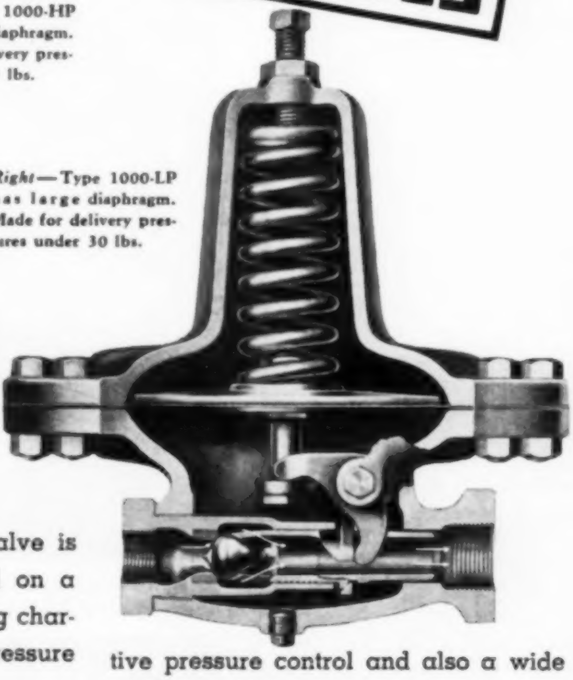


DAYS of able performance grow into YEARS

CASH STANDARD *Streamlined* PRESSURE REDUCING VALVES TYPE 1000



Left — Type 1000-HP normal size diaphragm. Made for delivery pressures over 30 lbs.



Right — Type 1000-LP has large diaphragm. Made for delivery pressures under 30 lbs.

The "1000" STREAMLINED Valve is a performer of top rank, rated on a basis of capacity — tight closing characteristics and close delivery pressure control.

The straight line flow promotes greater capacity — the "1000" is single seated and its valve makes line contact with its seat ring which accounts for its tight closing characteristics — the unusually long diaphragm spring insures sensitive pressure control and also a wide range of adjustment.

The benefits from this kind of top performance include: — practically zero in maintenance — elimination of failures — speedier production — smooth operation and no spoilage.

•

Write for Bulletin "1000" for full details.

•

CASH STANDARD
CONTROLS.. VALVES

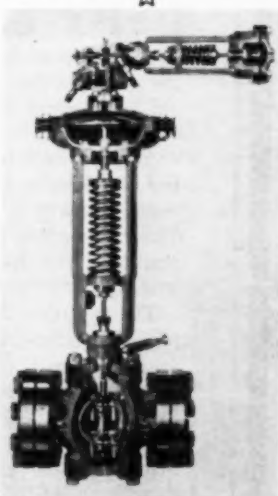
A. W. CASH COMPANY
DECATUR, ILLINOIS

OTHER VALVES *from the* CASH STANDARD LINE

Cash Standard Type 34 Pressure Reducing Valve. For practically all fluids. Has roller bearing, also roller guides that kill side strains and stop packing trouble —no lost motion.

Sizes: ½" to 12" inclusive. Highest initial pressure 800 lbs.; reduced pressure vacuum to 150 lbs. Bodies: iron, bronze, steel. Trim: iron, bronze, stainless steel. Ends: screwed, flanged, ammonia type, welding type. Bulletin 968.

☆



Cash Standard Type 30-AP Valve gives precise control of fluid pressures, through a pilot connected to the pressure under control. For steam, water, air, and most fluids.

Can be a pressure reducing valve or a back pressure valve depending on the way the control lines are connected. Pressures up to 600 lbs. Sizes ½" to 12" screwed; 1" to 12" flanged ends; wide variety of metals.

☆

Sulphate Pulp Bleaching

In the bleaching of chemical wood pulp, it must be remembered that any flow diagram or description is subject to modification dependent on the conditions at individual mills and the end use of the product.

The unbleached or "brown" stock resulting from the sulphate (kraft) pulping process is of varying composition in regard to its bleachability characteristics, although it is possible by proper adjustments to hold the variations within a fairly narrow range.

The multistage process of bleaching is essentially an integrated system of units which are interrelated to allow a continuous flow of the stock from one to the one following. In each unit or stage, the stock is subjected to chemicals under varying conditions of chemical and stock concentration, time of reaction, temperature, degree of alkalinity or acidity, etc., dependent on those factors which effect efficient and economical operation. Then the stock is thoroughly washed after each treatment to remove those materials which have been solubilized by the chemicals before passing on to the next stage.

The consistency of the brown stock is first regulated before the addition of chlorine. In this, the first stage, the materials are chlorinated to form three types of end products; the major constituent being water-soluble, the second type is soluble in caustic solutions, and the remaining matter of such nature that it must be oxidized before it is soluble in alkaline solutions. In some cases lime is added to the chlorinated stock to neutralize the acid, but this practice is not necessary if the mill equipment is made of corrosion-resistant materials.

After the stock has been chlorinated, it is washed free of soluble residue before passing to the second stage, where it is treated with caustic solution. This treatment makes it possible to wash out that portion of the chlorinated lignin which is soluble in alkali.

The oxidation of the remaining lignin is accomplished by the addition of sodium hypochlorite solution which completes the purification and raises the brightness of the pulp. It is usually performed in at least two stages so that the chemical charge can be decreased according to the requirements of the pulp thus preventing excessive degradation of the pulp.

When the bleaching process is complete, a weak acid, such as sulphurous, is added to the washed stock. The purpose of this addition is primarily to prevent color reversion, because the acid in addition to removing the residual active chlorine which would cause overbleaching with a consequent loss of strength and yield dissolves any calcium or iron compounds so that they may be washed from the pulp.

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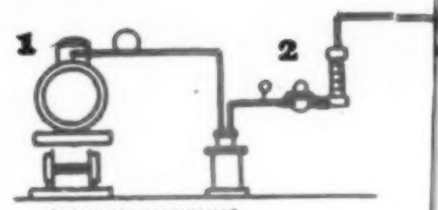
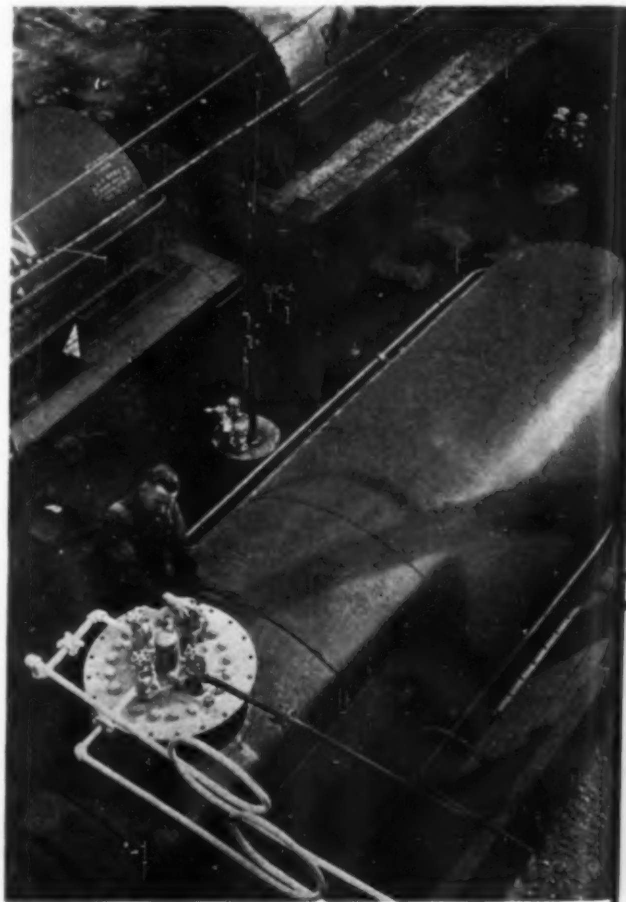
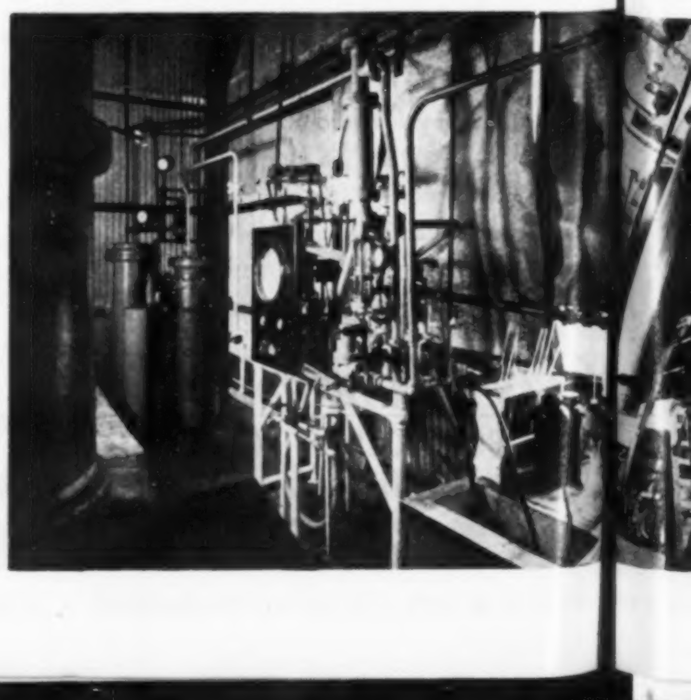


1 Chemicals most widely used in bleaching pulp are chlori caustic soda, lime, and calcium or sodium hypochlorite



2 Definite proportions of chlorine are used in bleaching. itial st dicating and recording flow control unit showing vapor tower



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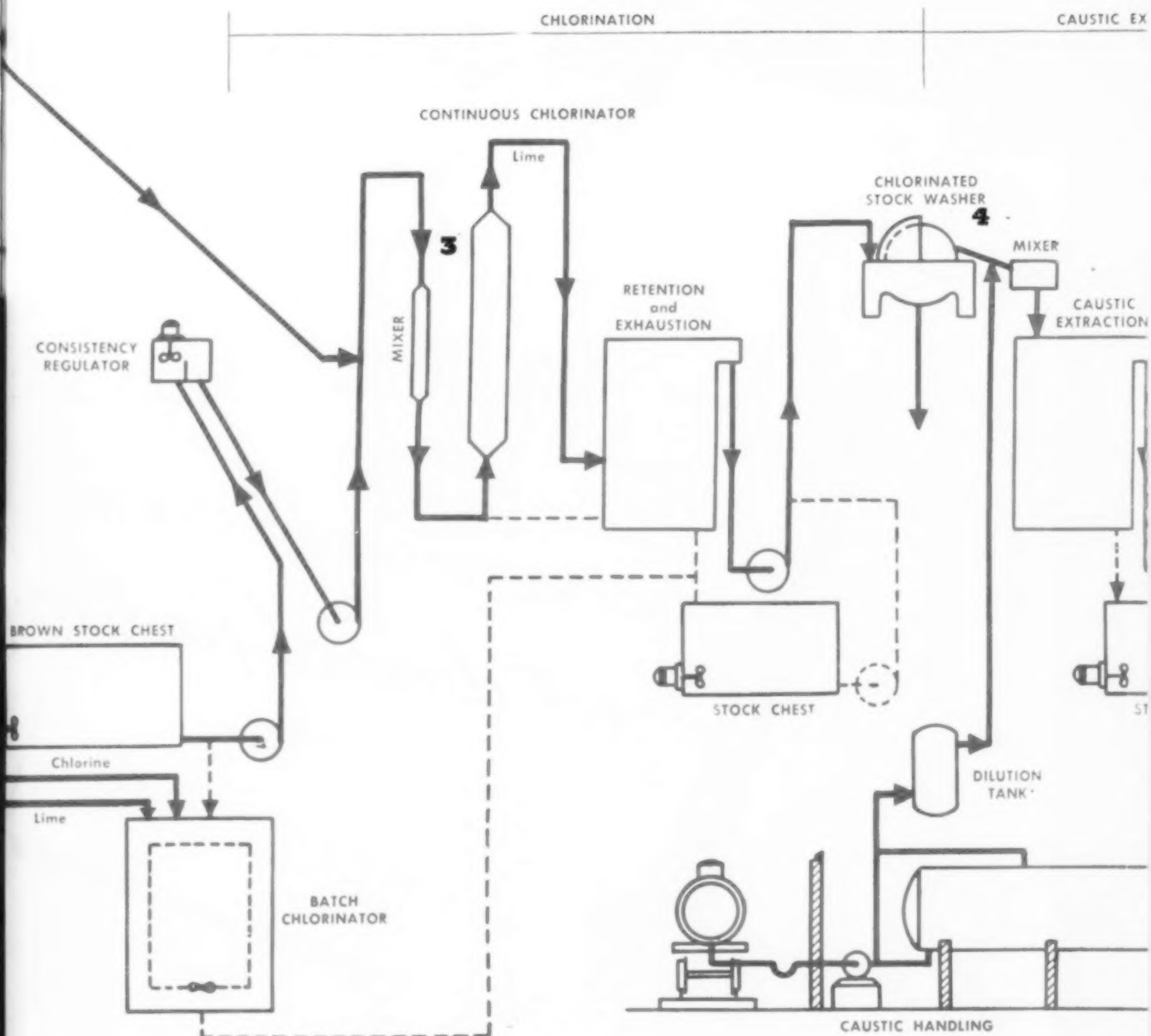
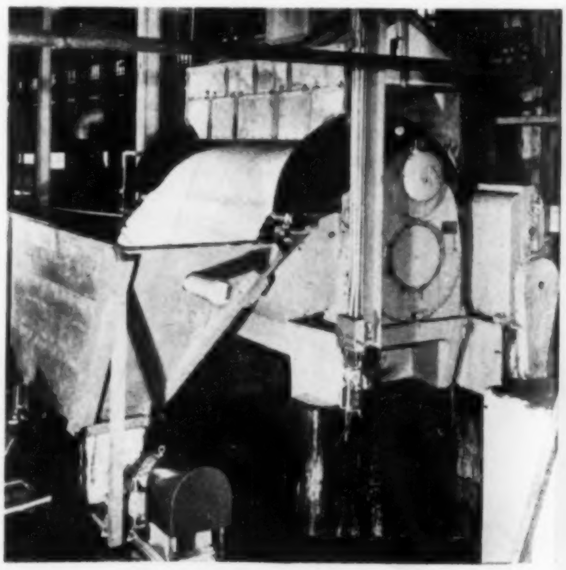
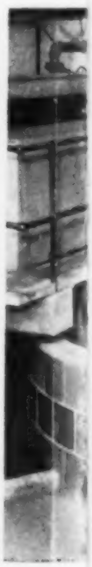


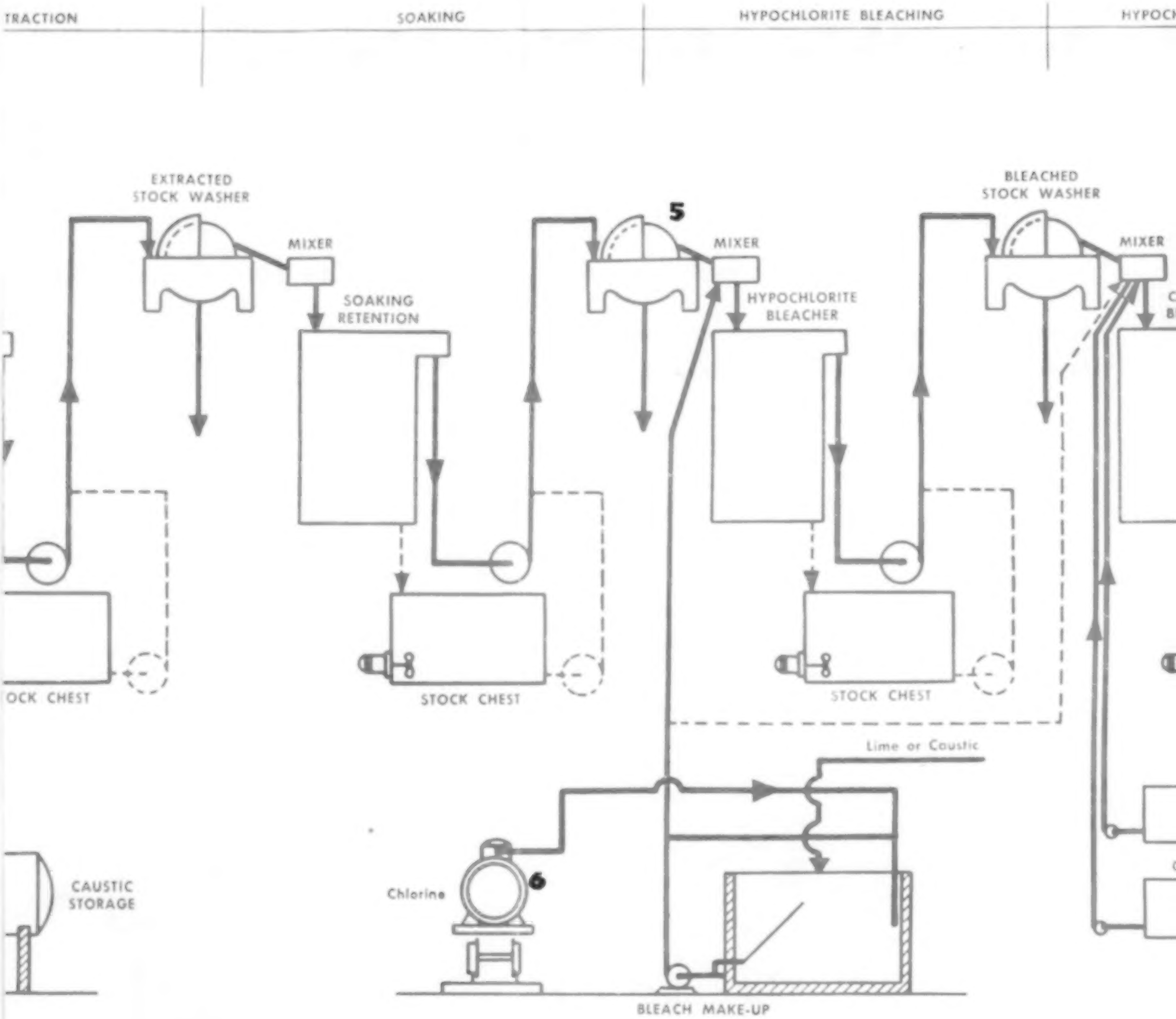
ching. nitial step in the bleaching process consists of chlorination
vapori tower either continuously or in batch operation

4 After suitable retention for complete exhaustion of chlorine the pulp is washed and thickened

5 Stoc
left fr

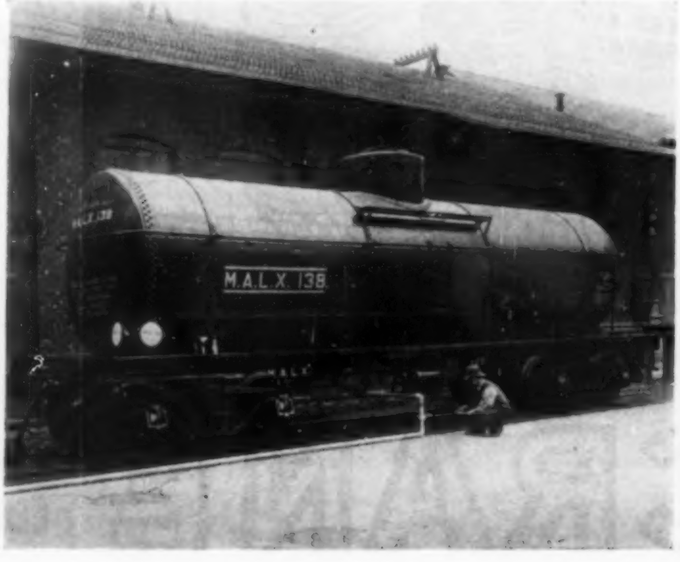




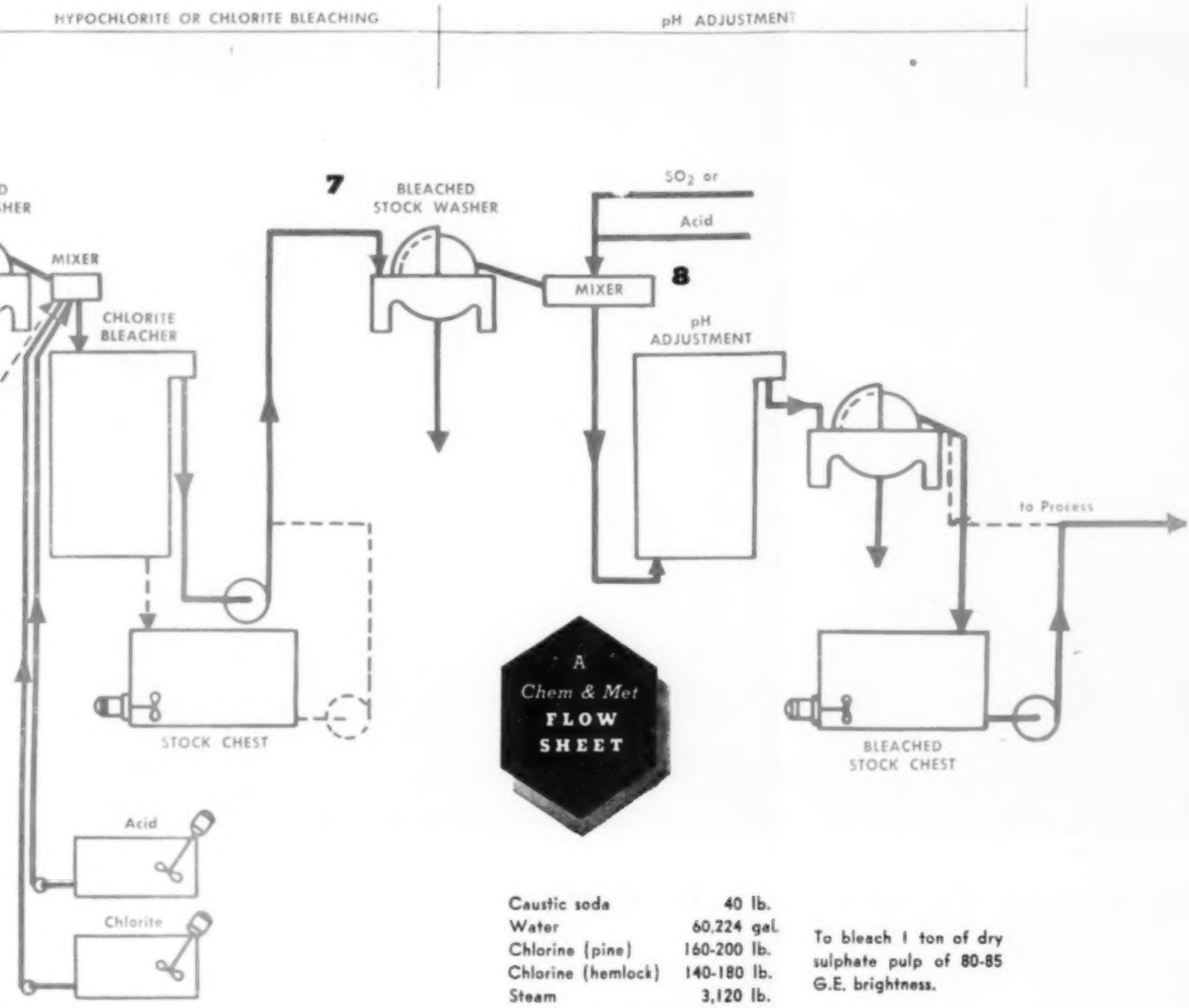


k can be thickened on the two deckers at the om which it is discharged into the chest

6 Chlorine is mixed in bleach make-up tank with lime or caustic to form hypochlorite. A caustic soda tank car



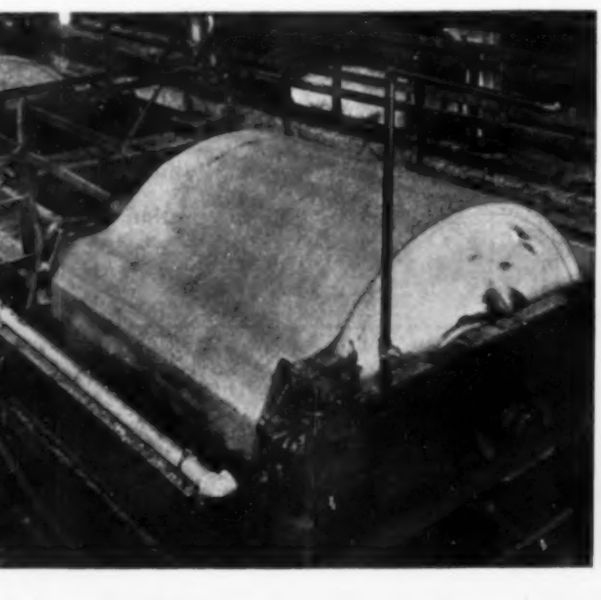
7 Any one o thickening an



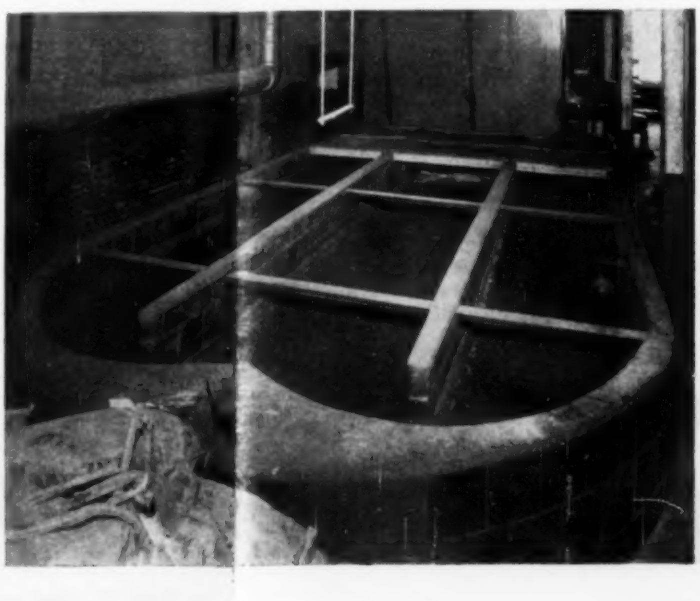
Caustic soda	40 lb.
Water	60,224 gal.
Chlorine (pine)	160-200 lb.
Chlorine (hemlock)	140-180 lb.
Steam	3,120 lb.
Labor	1 operator and 1 helper

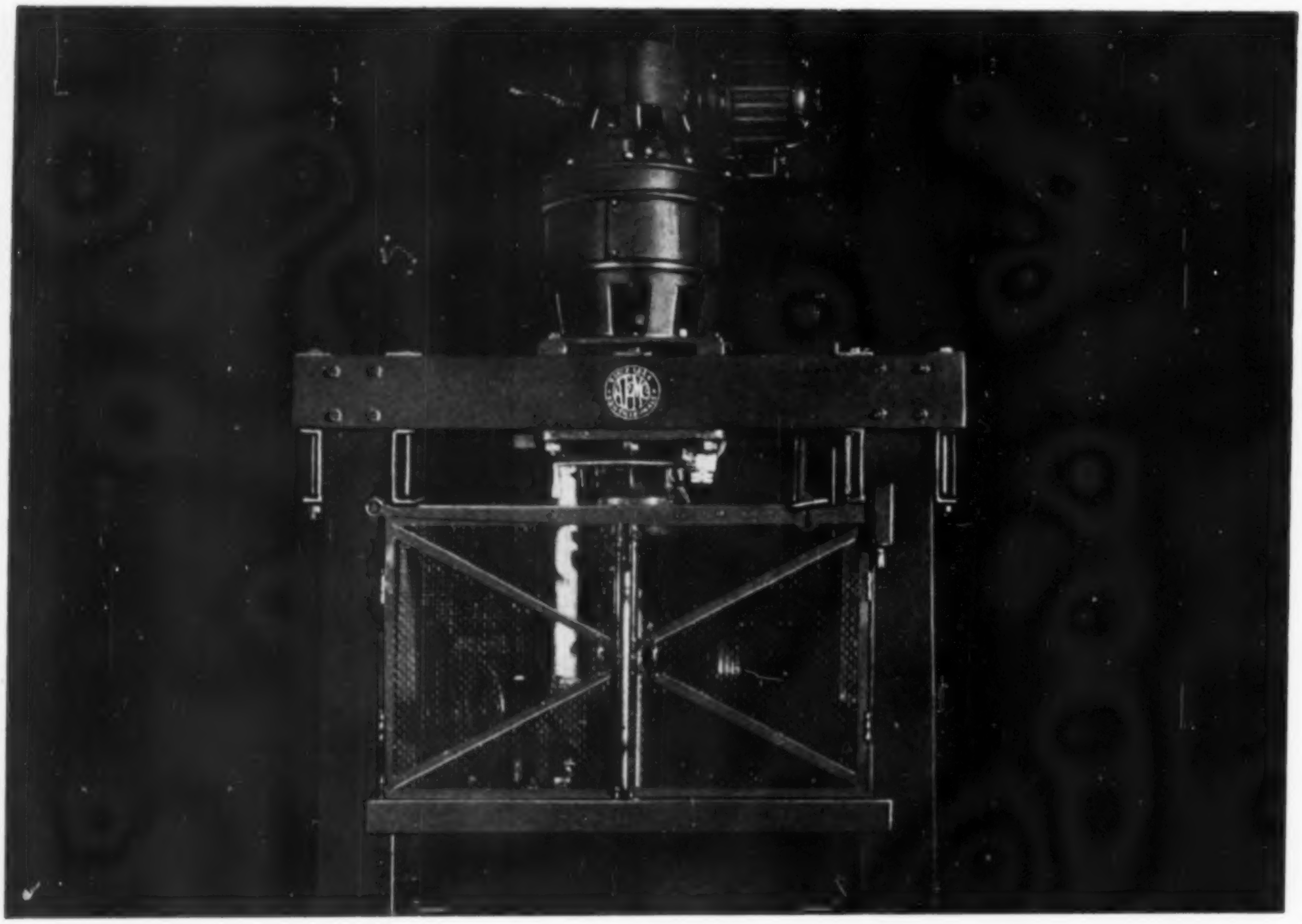
To bleach 1 ton of dry sulphate pulp of 80-85 G.E. brightness.

Any one of several types of washers can be used for ickening and removal of excess chemicals



8 After final hypochlorite stage, pulp is again washed and the pH adjusted by means of sulphur dioxide or sulphuric acid





Big Times Coming . . . If You're Not Behind Them

There's a big time coming, if you *save time* producing.

There's going to be room for expansion, if you know how to *save space.*

Perhaps we can help you do both. AT&M centrifugals have saved time and floor space in hundreds of processes.

In *filtration,* for instance, one manufacturer cut process time in half and saved 25 to 40 percent of an expensive chemical by installing compact AT&M centrifugals instead of a hard-to-clean, cumbersome system of filters.

In *precipitation,* another AT&M customer who used to wait for a particle-sized substance to settle in tanks now gets the benefits of immediate precipitation, finer degree of clarity, dryer cake, with a standard AT&M centrifugal.

In *impregnation,* the story is the same. AT&M centrifugals require less room than kiers, tanks or autoclaves, and often do the job much more successfully. Centrifugal force presses liquids into semi-solids or solids faster, more uniformly—then may throw off the surplus in the same swift, space-saving operation.

Dehydration? Coating? If you are not using centrifugals in these processes today, why not find out how much time and floor space they might be able to save you.

AT&M engineers are now available, as immediate national needs permit, to cooperate with you in planning installations of standard AT&M centrifugals . . . or special centrifugals engineered to solve your particular production problem. Strict confidence will be preserved. Write American Tool & Machine Co., 1415 Hyde Park Avenue, Boston, or 30A Church St., New York, N.Y.

Good Times or Hard Times
—AT&M Centrifugals Save
Time and Space in—

Extraction	Precipitation
Dehydration	Impregnation
Filtration	Coating

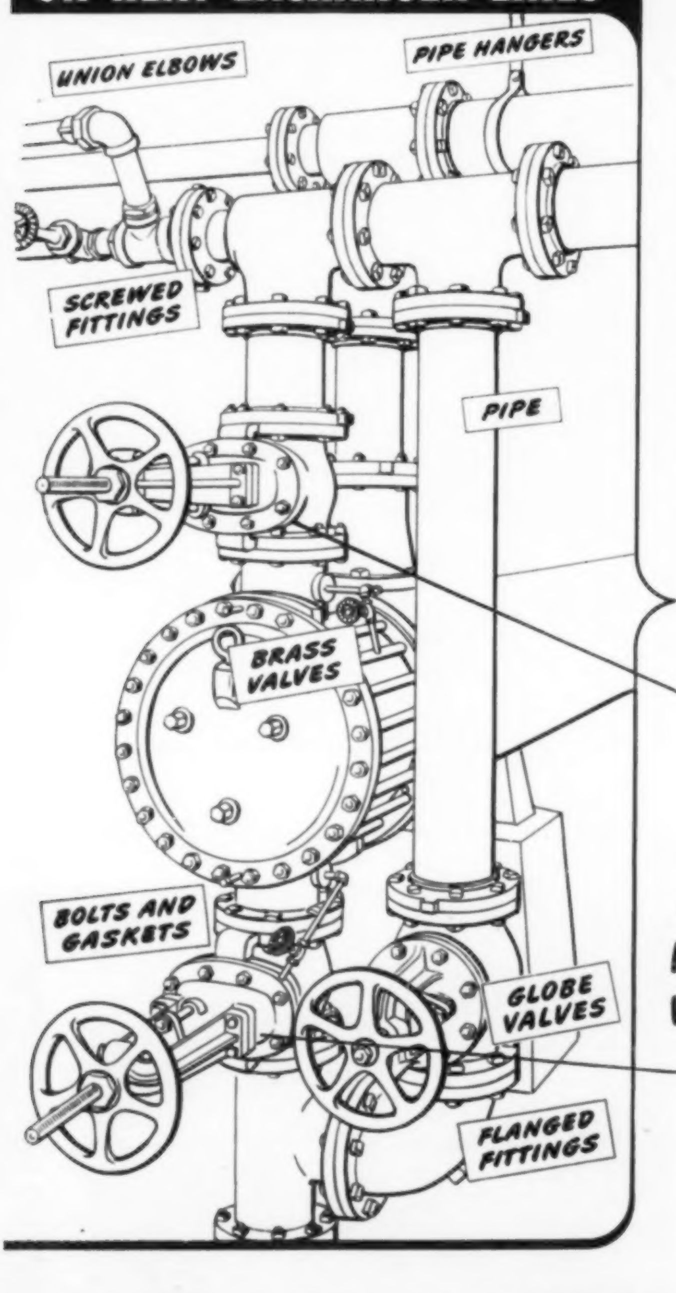
A T and M

A T & M CENTRIFUGALS SAVE TIME AND SPACE

Everything for Pipe Lines - -
you can get it from Crane

One high standard of quality throughout . . . One source of supply . . . One responsibility for all materials

ON HEAT EXCHANGER LINES



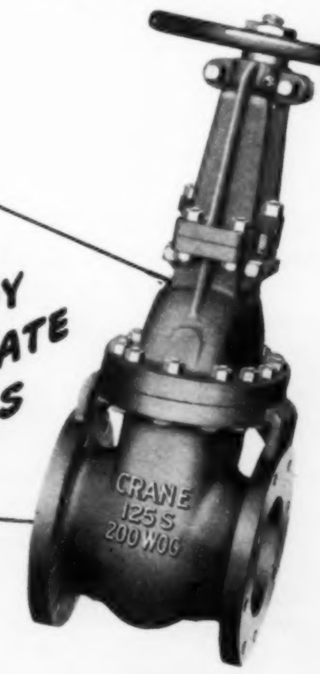
FOR these advantages you can thank the unusual completeness of the Crane line of piping materials, shown by the installation at left. Every part, from pipe and pipe hangers to valves and fittings, comes from Crane. And from end to end, the performance of every part is assured by Crane superior quality.

Take a look at Crane quality through the iron body wedge gate valves in this hook-up. The body is strengthened to resist line strains. Port openings are straight through, giving streamline flow. A deeper stuffing box lengthens packing life. The stem has adequate power for positive seating, and extra long guides keep disc travel true.

With such refinements marking every item in the world's largest line of piping equipment, Crane is your magic word for better fluid handling service whether you need a single pipe fitting or an entire system. Crane Co.'s 89-year leadership in its field sees to that.

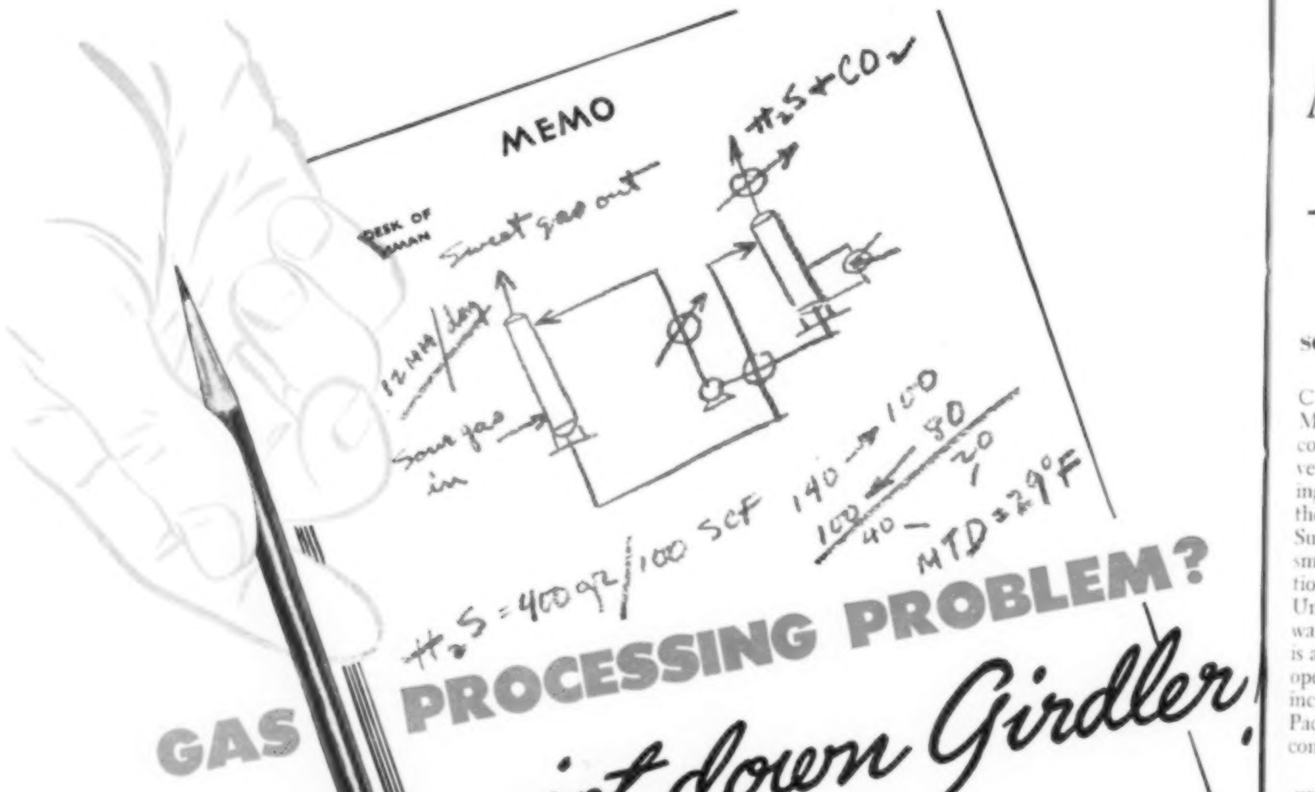
CRANE CO., General Offices: 836 S. Michigan Ave. Chicago 5, Illinois.

STANDARD IRON BODY WEDGE GATE VALVES



CRANE

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS



GAS PROCESSING PROBLEM?

jot down Girdler!

When confronted with a problem requiring a more efficient and economical gas process, call on Girdler! Time-tested, practical processes are already available for most purposes. An unprecedented problem? Then, remember this. Girdler has a complete staff — splendid research facilities — and a backlog of experience gained by solving many engineering and construction problems in connection with gas processing.

Inquiries involving gases, gaseous mixtures or liquid hydrocarbons receive action-attention from a pioneer-minded, foresighted organization. So — next time, jot down Girdler!

GIRDLER PROCESSES

for manufacture, purification, separation and dehydration . . .

Consult Girdler on your problems concerning hydrogen sulfide, carbon monoxide, carbon dioxide, natural gas, refinery gases, liquid hydrocarbons, hydrogen, nitrogen.

Originators of the Girbotol Process

The GIRDLER CORPORATION

Gas Processes Division · Louisville, Ky.

CHEMICAL ENGINEERS AND CONSTRUCTORS

NEW PRODUCTS AND MATERIALS

JAMES A. LEE, Managing Editor

SOLVENT EMULSION CLEANER

A solvent emulsion cleaner, Pennsalt E. C. No. 10, developed by Pennsylvania Salt Manufacturing Co., Philadelphia, Pa., combines soap emulsifying action with solvent penetration. Composed of emulsifying agents and suitable solvents, it is of the self-emulsifying, non-phenolic type. Suggested uses are for removing grease, oil, smut, and drawing and buffing compositions from metals and painted surfaces. Undiluted material may be applied cold or warm by dipping, spraying or brushing. It is applicable to power washer and soap type operations in water emulsion form or to increase effectiveness of alkaline cleaners. Packed in 55 gal. drums, it is available in commercial quantities.

CERAMIC COMPOSITION

A ceramic type composition which produces electrically conductive coatings that may be applied to a wide variety of nonconductors including glass, plastics, porcelain, soapstone, wood, cloth and paper is being manufactured by E. I. du Pont de Nemours & Co., Wilmington, Del.

These coatings can be applied by spraying, dipping or brushing, followed by air drying and, in some cases, baking. Containing silver powder, the composition produces a surface of low electrical resistance and high conductivity, and is valuable for use in electrical condensers and other units employed in electrical circuits. Aging, or exposure to sulphides has only a slight effect upon the conductivity.

Several different formulations of the material are being produced, each designed to meet the varying requirements of different base materials and degrees of adherence and film toughness. The coatings are dull, metallic gray in appearance. A thermoplastic conductive cement is one form. Others include a conductive coated cloth and a flexible conductive film. Four types are being produced but other formulations are available for evaluation purposes.

INSECTICIDE DUSTS

Two chemical dusts that give the grower a combination insecticide and fungicide against a wide range of insects and diseases have been announced by E. I. du Pont de Nemours & Co., Wilmington 98, Del. These materials, designed especially for growers of potatoes and of farm garden crops, are Du Pont Potato Dust and Du Pont Garden Dust. Both have been tested under field conditions. These products contain no lime or any other harmful diluents, are easy to mix and apply, and can be dusted or sprayed at any time of day.

Du Pont Potato Dust contains calcium

CONTENTS

arsenate insecticide and Copper-A Compound fungicide. It is recommended for control of Colorado potato beetles, flea and blister beetles, hornworms, leaf hoppers, early and late blight and other leaf-spot diseases. The potato dust may be used on tomatoes, eggplants, and peppers, but in that case the fruits should be washed thoroughly before using, to remove any possible poisonous residue.

Du Pont Garden Dust contains synthetic cryolite insecticide, a material specially manufactured for fineness and uniformity, and the Copper-A Compound fungicide. It is recommended for Mexican bean beetles, flea beetles and blister beetles, striped and twelve-spotted cucumber beetles, leaf hoppers, various caterpillars, "worms" and "slugs" and other chewing insects, as well as various leaf spots, mildews, and "blights" of vegetables and flowers. For sucking insects such as black or green aphis, a nicotine dust or spray should be used.

EMULSION CLEANER

A concentrate type emulsion cleaner, Pennsalt E. C. No. 2, comprising soaps, blending agents, and co-solvents for industrial grease cleaning applications, and soluble in water and in hydrocarbon solvents has been announced by the Special Chemicals Division of Pennsylvania Salt Mfg. Co., Philadelphia, Pa. It may be diluted with from 5 to 20 parts of suitable solvents such as low-cost kerosene, Stoddard solvent, or light fuel oil distillate. Uses suggested by the manufacturers are as an emulsifying solvent in removing carbonized oils, grease, smut, and drawing and buffing compositions. It finds use as a precleaner, prior to electroplating, yielding a physically clean surface, and is also applicable to power washer and soak tank operations in water emulsion form or to increase the effectiveness of alkaline cleaners. The material also acts to inhibit rust formation. Packed in 55 gal. drums, it is available in commercial quantities.

METAL CELLULOSE GLYCOLLATE

The aluminum salt of cellulose glycollic acid in which carboxy methyl (CH_2COOH) radical comprises the substituent group is known as Collocel A by the manufacturers, the Dow Chemical Co., Midland, Mich. It is unlike sodium cellulose glycollate, Collocel S, in that it is insoluble in water. Solution of Collocel A can be effected through the use of inorganic or organic bases. It is produced as a cream to light brown powder passing a $\frac{1}{16}$ in. mesh screen. The apparent density of this product is 0.9 or approximately 56 lb. cu.ft. Collocel A has been successfully used to improve the transparency of a glassine sheet. It can be used to produce grease and oil proof papers. The wet strength of the paper can be increased by sizing with this material but the water absorbing property of the paper will be markedly reduced. The extensive compatibility of the material with direct and acid dyestuffs coupled with its inherent usefulness as a thickener has led to the successful development and application of Collocel A as a print paste thickener in the textile industry. Its solubility in aqueous solutions of amino alcohols indicates that this derivative should find application as a thickener or stabilizer since many of these alcohols are now used in cosmetic formulations. Films cast from ammoniacal solutions are transparent, hard, and possess excellent tensile strength. They are stable to light and heat. They are resistant to turpentine, vegetable and mineral oils and greases, and can be made water insoluble by incorporation of reactive materials such as water soluble urea and melamine resins and polycarboxylic acids which possess functional groups capable of reacting with the Collocel A molecule.

SODIUM CELLULOSE GLYCOLLATE

The neutral sodium salt of cellulose glycollic acid or carboxyemethyl cellulose is known as Collocel S by the manufacturer, the Dow Chemical Co., Midland, Mich. It is an interesting addition to the group of commercially available water

soluble cellulose esters because besides being a tough film forming material and possessing other useful properties characteristic of cellulose esters, it has special characteristics by virtue of its salt character. It is produced in the form of a dry powder which is soluble in water but insoluble in all organic solvents. It is unaffected by oily or greasy materials of animal, vegetable or mineral origin. It is odorless and nontoxic. Collocel S is stable to heat without discoloration at temperatures up to 175 deg. C. Although it will burn when once ignited, it offers no greater fire hazard than cellulose in the same physical form. Collocel S is stable to light and does not discolor on long exposure to ultra-violet light. It is available in two viscosity types, low and high.

The properties of the material recommend it for use wherever natural gums such as locust bean, karaya and tragacanth are employed. It can be used in formulations requiring a thickener, stabilizer, adhesive compound, emulsifying agent or protective colloid. It is suitable for application as a pigment disperser, print paste thickener, warp sizing agent and assistant or base for water soluble inks. Collocel S is easily removed from textiles by mild washing and does not form precipitates with hard water. Films are grease and oil resistant and should be useful in coatings requiring this property.

SYNTHETIC RUBBER

A new product which may result in better automobile tires than can be made from GR-S (Buna S) rubber, because of greater energy resilience and higher resistance to cut and tear tendencies has been announced by Goodyear Tire & Rubber Co., Akron, Ohio. Butadiene is an ingredient but another chemical has been substituted for styrene in the new synthetic.

ALL-PURPOSE INSECTIFUGE

As a result of research by government agencies, the U. S. Industrial Chemicals, Inc., New York, N. Y. has announced an insect repellent which performs with high effectiveness in all parts of the world, against all types of insects including mosquitoes, biting flies and chiggers. Although the complete composition of the material cannot be revealed at present, it can be stated that one vital ingredient is the company's Indalone. It owes its unusual repellency to its bitter taste and its effect on the nerve endings in the feet of the insects.

INSULATING FIREBRICK

In order to make possible speedier, more economical installations of insulating refractory linings, Johns-Manville, New York, N. Y. has developed insulating Fireblok. It is available in four different grades, each suitable for a different range of temperature conditions.

One Fireblok is said to cover more surface than is covered by five full-size brick. This large size, compared to the standard firebrick unit makes installation faster and materially reduces the number of joints, thus requiring a minimum of mortar for bonding. It can be used wherever insulating firebrick are recommended, but is particularly suitable for the lining of doors, for suspended arches, and, when tapered, for sprung arches of exceptional stability. It can be cut with a saw and shaped with a rasp. Most special shapes can be either shop or field cut from standard slabs, thus reducing the inventory of special shapes that need be kept in stock.

PROTECTIVE PACKAGING

It is said that Hercules' Ethyl Cellulose Plastic Peel has reduced rust proofing to a simple procedure and slashed man-hours by as much as 90 percent. Metal parts are quick-dipped in a hot liquid mixture of ethyl cellulose, synthetic resins, and oil. In seconds they are coated, the plastic hardens, and the protective oil is sealed in. The plastic is permanently tough but easily peels off.

While ethyl cellulose hot-dipped plastics were developed to handle the war emergency, they are expected to have a number of industrial applications such as the protection of finely finished parts for aircraft and automotive engines during shipment, protection of machine tools from corrosion and similar applications. Also there will be a large number of plant installations put up for war purposes, which will need protection from corrosion. These plastics may be applied to large stationary pieces to protect them indefinitely. Such coatings, of course, can be readily removed by stripping and will be much tougher and more durable than oil, wax or grease coatings now in use. In addition to the transparent formulations, a translucent formulation has been approved by Army Ordnance because some parts must be individually boxed or tagged with part numbers for identification and in those cases transparency is not necessary. These materials are products of Hercules Powder Co., Wilmington, Del.

SHOE COATING

A solution of a vinyl resin, said to be "impervious to sulphur-base cutting oils, kerosene, paint, lacquer, cleaning and degreasing compounds and other organic solvents" has been announced by the Resistoflex Corp., Belleville, N. J. Shoes are merely dipped in Compar shoe coating and allowed to dry. The wearer will be protected against allergy, dermatitis and folliculitis caused by oils and solvents. The coating resists the destructive action of the solvent and yet leaves the leather flexible. It will protect and greatly extend the life of the shoe, according to the report of the manufacturer.

FURNITURE FINISH

A better finish for home, school and office furniture, much tougher than present varnishes or lacquers, is promised after the war by the Finishes Division of E. I. du Pont de Nemours & Co., Wilmington 98, Del. A formulation described as "unique" has been developed at the company's laboratories for use as a base or prime coat. Its value lies in the extraordinary adhesion it provides for the top coat. The new so-called penetrating primer, by affording improved anchorage, permits the use of higher scratch-resistant finishing lacquers. Such super-tough pyroxylin lacquers have long been available but were impractical because a sufficiently strong adhesive bond with a wood surface could not be obtained.

FLAME-PROOF COTTON

Efforts of the Department of Agriculture, the National Bureau of Standards and the Surplus Commodities Corp. have resulted in the development of a flame-proof cotton which is being placed on the market. The new cotton insulation, marketed under the trade name of Reyn-o-cell, is now being manufactured in six mills in the country and distributed through the General Electric Supply Corp.

The material is a 3-in. blanket of flameproofed and heat-resisting cotton protected on one side by a moisture-vapor-proof paper. It weighs only about 4 oz. a square foot, and is the lightest insulation yet produced. Tests show the material saves up to 30 percent of fuel. Instead of settling, the material fluffs up from vibration to greater thickness and becomes more effective.

BACTERIA REPELLENT

Textiles, if treated in the finishing bath with a new chemical developed by Gallowhur & Co., New York, N. Y., are said to be resistant to bacteria and fungi growth. Its developers have given the treatment the name the Puratized process. It will probably not be generally available for application to textile for civilian use until after the war. At the present time it is being used for the treatment of textiles for military purposes. Puratized process formulations N5-X, N5-D, and N5, may be introduced into the fabric by means of an aqueous phase, or by an oil-in-water type of emulsion, and then insolubilized in situ in the fabric at a temperature as high as 200 deg. F. During the operation the active ingredient combines in part with cellulose

HIGH IMPACT PHENOLIC RESIN

The development of a high impact-resistant molding material, BM-16468, has been announced by Bakelite Corp., unit of Union Carbide and Carbon Corp., New York, N. Y. The material is a black phenolic plastic having a strong filler rather than chopped fabric which is employed for other types of shock-resistant materials. Impact strength of BM-16468 is about 20 to 25 times greater than general purpose phenolics.

Physical Properties

	Direction of stress	
Compressive strength, lb. per sq.in.	Parallel	27,500–32,700
	Transverse	15,600–18,000
Tensile strength, lb. per sq.in.	Transverse	7,500– 8,500
Flexural strength, lb. per sq.in.	Parallel	12,000–12,900
	Transverse	10,200–14,200
Maximum deflection—in.	Parallel	.086– .122
	Transverse	.095– .118
Impact strength, Izod	Parallel	3.49–4.84

We'll gladly send sample of new Monsanto product

HB-40 A Clear, Mobile High-Boiling Hydrocarbon

With its unique combination of chemical and physical properties, HB-40 should find many uses in a wide variety of industries. A few of the possible applications of this high-boiling, stable hydro-carbon oil, with its unusual spread between freezing and boiling points, are listed below.

SUGGESTED USES:

1. As a hydraulic fluid in thermal controls.
2. As a plasticizer for vinyl, polystyrene, methacrylate resins and for asphalt or gilsonite base paints.
3. As a textile lubricant and softener, in particular for rayon and woolen goods.
4. As a constituent of leather dressings, particularly those formulations used for softening leathers.
5. As a solvent for various types of oils, resins and waxes.
6. As a solvent for industrial processing. (Such as extraction of organic materials from waste liquors.)
7. As an absorber to remove volatile organic compounds from gases. (Such as removal of naphthalene from by-product gas.)
8. As a solvent where low volatility and low flammability are essential or desirable.

PHYSICAL PROPERTIES:

Appearance: Almost colorless, mobile, oily liquid, with faint pleasant odor.

Color: Less than 500 APHA (Darkens on exposure to sunlight.)

Specific Gravity: 1.005 ± 0.010 @ 25/15.6°C. — (8.37 pounds/gallon, average).

Refractive Index: 1.5540 — 1.5740 @ 25°C.

Coefficient of Expansion: 0.000741 cc/cc/°C.

Carbon Residue: (Conradson) 0.02%.

Ash: (10-gram sample) Nil.

Neutralization Number: 0.03.

Steam Emulsion Value: 45.

Stability to Heat: Appears to be relatively stable at the boiling point (at least in glass), and does not readily oxidize. However, it does decompose at 300°C. under pressure, in iron.

Stability to Acids and Alkalies: Appears to be relatively stable, and undergoes no significant changes in composition when kept in contact with boiling 10% aqueous solutions of H_2SO_4 or NaOH at atmospheric pressure.

Vapor Pressure

°C.	MmHg
150	2
165	4
175	6
190	10
205	16
225	28
245	50
250	71
300	235 (est)
325	410 (est)
357	760

Distillation Range:

	Deg. C.
Start	345 (corr.)*
10%	353 "
50%	359 "
90%	393 "
95%	420 "

*Corrected for stem exposure

Flash Point: 345°F. ASTM D92-24.

Flame Point: 385°F. ASTM D92-24.

Pour Point: Minus 28°C.

Solubility: Not soluble in water, but is miscible in all proportions at room temperature with a number of solvents and oils.

Compatibility: Compatible in varying proportions with polystyrene, ethyl cellulose and methacrylate resins.

Viscosity — SUS. 136.5 @ 100°F.
38.4 @ 210°F.

ELECTRICAL PROPERTIES: (Typical Data)

Dielectric Constant: 2.53 at 25°C. 2.35 at 100°C.

Dielectric Strength: 30 kv., average, at 25°C.

Resistivity: 5000 x 10^9 ohms/cm^3 at 100°C.
Above 17,000 x 10^9 ohms/cm^3 at 25°C.

Power Factor: 0.12% at 100°C. at 1,000 cycles.

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Without cost nor obligation to me, please send experimental sample of Monsanto HB-40.

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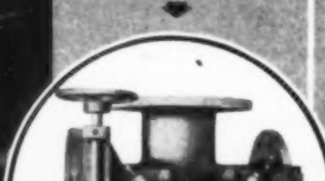
Designed for HIGH or LOW Working Pressure

R-S QUALITY PRODUCTS SINCE 1908

No. 610

No. 611



Patent Applied For

These two illustrations of R-S Butterfly Valves exemplify the wide pressure range (15 to 900 psi) handled by this type valve as well as the simplicity of design.

When completely assembled, the heavy duty power operated valve, No. 610, will be equipped with a dual stuffing box, hand wheel declutching unit, hand jack and mercury switch. Shaft supported on ball or sleeve bearings enclosed in grease packed journals—pressure lubrication.

The manually operated three-way valve, No. 611, is utilized for quick interchange and mixing service. It is adapted to power operation as well as high pressures and elevated temperatures.

This visual presentation of R-S Engineering speaks for itself. If you are interested in simplified control and shut-off of volume and pressure, write for the complete story contained in the new R-S Catalog No. 14-B.

VALVE DIVISION
R-S PRODUCTS CORPORATION
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R-S Streamlined BUTTERFLY VALVES

molecules in the fabric to become an integral part. Several types have been developed for various uses.

ALKALI FLUOBORATES

Three alkaline fluoborate salts, ammonium, potassium, and sodium, are available in experimental quantities from Pennsylvania Salt Manufacturing Co., Philadelphia, Pa. Ammonium fluoborate (NH_4BF_4) has a sp.gr. of 1.85 and is freely soluble in water and alcohol, giving a slight acid reaction in aqueous solution. It sublimes at 230 deg. to 240 deg. C. Potassium fluoborate ($K BF_4$) has a sp.gr. of 2.5 and is only very slightly soluble in hot or cold water or alcohol. It has a melting point of approximately 500 deg. C. and at elevated temperatures decomposes to KF and BF_3. Sodium fluoborate ($Na BF_4$) is readily soluble in water but only sparingly soluble in alcohol, the aqueous solution giving a slightly acid reaction. It fuses below red heat and is slowly decomposed to NaF and BF_3. These materials, which are also known as borofluorides, find uses in welding fluxes, as oxidation inhibitors in sand casting of aluminum and magnesium, and in heat treatment of aluminum alloys.

THREE-IN-ONE GLUE

One glue that can be used in three different ways, cutting costs, inventory and production time, has been formulated by I. F. Laucks, Inc., Seattle, Wash. This glue, Lauxite Hot Press Urea Resin ("S-9XC-U"), can be used straight, with a fortifier (to meet standard three-hour boil test), or with wheat flour of any gluten strength.

Formerly it was necessary to have different glues for these three different type jobs. Special importance is attached to the fact that this new formulation can be used with any wheat flour regardless of gluten strength and still obtain a free spreading, uniform viscosity glue.

TRIVALENT CHROMIUM

Trivalent chromium is now available for chromium plating according to the Warner Laboratories, Chicago, Ill. The Warner process with its Skalite chromium salt, is said to provide substantially greater plating efficiency. Procedure for both hard and decorative chromium has been simplified. Plant investment is immeasurably less. The need for special chrome plating equipment has been eliminated according to the company. Time, electrical energy and salts required are only 20 percent of the old process. Due to the bath's non-gassing characteristics and substantially increased throwing power there is no longer need for special contour anodes on intricate objects. The bath is also non-corrosive. The new bath is non-poisonous, chromium plating is removed from the hazardous occupation classification with attendant savings in liability insurance.

MILDEW PROOFING COMPOUND

Mildew proofing and water repellency are said to be combined in Ceral TGI, announced by the Sandoz Chemical Works, New York, N. Y. The product, an emulsion containing dihydroxy-dichloro-di

phenyl methane, possesses high stability both in its concentrated form and when diluted to working strength. Fabrics treated with this compound are said to be non-toxic and garments so treated may be worn in contact with the skin.

ALUMINUM YARN

There has been an announcement by Reynolds Metal Co., Richmond, Va., that it has developed an aluminum yarn which is made by cutting fine strips from large rolled sheets. One pound of aluminum has made six miles of this type of strip. Sheets coated with cellulose acetate have greater tensile strength. During the coating process any color may be imparted to the metal. After cutting the yarn may be used in its pure state or twisted around cotton or rayon to make aluminum coated yarns. The yarn is washable and may be dry cleaned. It does not tarnish.

INSECTICIDE FOR TYPHUS

The production of DDT, the new and powerful chemical weapon protecting the armed forces from typhus, will be multiplied by the construction of a plant by the E. I. du Pont de Nemours & Co., Wilmington, Del. A difficult compound to make, DDT, or dichloro-diphenyl-trichloroethane, is such an effective insecticide that the Army recently flew the first 500-lb. cargo produced at a du Pont pilot plant to an overseas front. Tonnage manufacture at the new half-million dollar plant to be built at government request will be entirely devoted to Army and Navy use. Work is expected to start almost immediately.

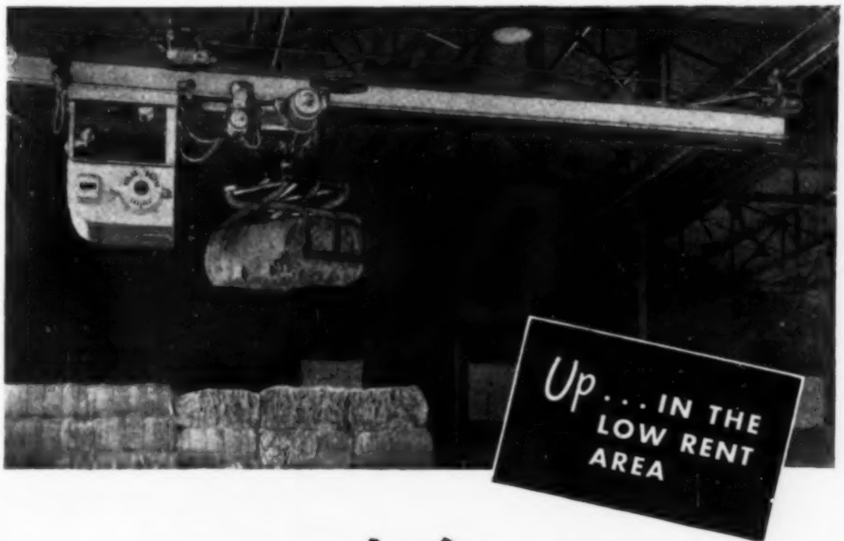
Some conception of DDT's potency may be had from the fact that a single application dusted on clothing gives protection from disease-carrying vermin for one month.

The chemical was first synthesized 70 years ago by a German chemist, but its use as an insecticide was patented by a Swiss firm, Geigy, Inc., in 1939. Previously employed largely as a moth repellent and a plant lice control, the U. S. Department of Agriculture revealed last May that its scientists had successfully tested its utility against body lice. The Army soon recommended its adoption as standard equipment, replacing the louse powder then in use.

RESIN CHEMICAL

A plastic covering that removes all the hairs from a pig when it is peeled off has given the housewife more high-grade pork cuts, ham, bacon, lard and other pork products, Hercules Powder Co., Wilmington, Del., reports.

The chemical shaving method, which has been adopted by meat packers, also saves processing time and reduces dehairing costs. Coating the pork carcass with Brisgo, a resin chemical made by Hercules, packers now get rid of the toughest whiskers and stubble in a simple stripping operation. The pig is dipped in a tank, and carried on the dressing conveyor to an operator who slits the warm plastic suit and unrolls it. In another method, the chemical is brushed on and scraped off. The removed plastic goes back to a remelting tank and is used over and over again.



monorail hoists

YOU SHOULD KNOW MORE ABOUT SHEPARD NILES CAB-OPERATED MONORAILS

1. HOIST MOUNTING — The hoisting unit is mounted parallel to the runway, if side pulling at right angles to the runway is likely to occur—or, where the load hook must operate close to the end of the runway, the hoist can be mounted at right angles to the runway.

2. TROLLEY DRIVE UNITS —Monorails are provided with either one or two trolley drive units, depending upon the travel-speed required along the runway.

3. FULLY ENCLOSED OPERATING PARTS—All operating parts of the hoisting unit are fully enclosed and completely protected from moisture and dust.

4. BALANCED DRIVE—Stresses are evenly distributed in the hoisting unit through the use of the Shepard "Balanced Drive".

5. LUBRICATION—Entire gear train operates in a bath of oil.

6. BEARINGS — Antifriction bearings used throughout.

7. OPERATOR'S CAB supplied either open or completely enclosed and weatherproofed for outdoor service.

deliver the goods . . . quickly, economically . . . day after day

Up, out of the way of important production, Shepard Niles Cab-operated Monorail Hoists go places—and get things done.

They are especially recommended for long runways, where rapid travel speeds are required.

When operated on the single beam of a Transfer Crane, complete areas are covered quickly, completely and continuously.

When operated in conjunction with a transfer crane, which permits the hoist to serve adjacent bays through a system of overhead switches and spurs, a Cab-operated Monorail achieves its greatest efficiency. No spot, indoors or out is so inaccessible that it cannot readily be serviced with a Monorail.

Qualified Shepard Niles sales engineers are located in all war-production centers to consult with you in determining the exact type of equipment you will need to obtain maximum efficiency in your materials-handling operations.

SHEPARD NILES MAINTENANCE MANUAL — FREE. 106 pages, amply illustrated by line and sectional drawings.

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CRANE & HOIST CORPORATION

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NEW- *Externally-Accessible Stuffing Box*
Can be repacked *from the outside* without draining tank.

NEW- *Self-Sealing Shaft*
Prevents loss of liquid while repacking stuffing box.

NEW- *Weather-Proof Motor Cover*
Assures all-weather motor protection.

NEW- *Adjustable Motor Support*
Adapts itself to mounting conditions.

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PORTER Better Built Equipment
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CHEMICAL ENGINEERING NEWS

SULPHURIC ACID CAPACITIES WILL BE INCREASED

SULPHURIC ACID production has reached a new high with total capacity now estimated at approximately 9,300,000 tons a year, the War Production Board announced on Feb. 28. In addition, new facilities with an estimated capacity of 800,000 tons yearly are under construction. These figures refer to 100 percent acid.

Total present capacity for private production (i.e., production by the user) is estimated by WPB officials to be approximately 706,000 tons per month, or 8,475,000 tons per year. Plants in this category now under construction and expected to be completed by the fourth quarter of 1944, are expected to increase these figures by 66,500 tons per month, or 798,000 tons per year, excluding ordnance acid. Reports from commercial plants (i.e., those producing sulphuric acid for sale) indicate operation at over 100 percent rated capacity.

Definite requirements figures are still unavailable for 1944 but indications are that the following additional tonnage will be needed per month:

Superphosphate program, 26,300 tons; ammonium sulphate, 3,700 tons; rayon and cellulose film, 8,300 tons; petroleum refineries, 24,000 tons; titanium dioxide and other pigments, 2,300 tons; chemicals, 3,000 tons; iron and steel, 13,400 tons; other metallurgical, 1,000 tons.

WPB officials said that present indications were that all but 14,500 tons per month of the anticipated increase can be met.

RESEARCH LITERATURE FROM DOCUMENTATION INSTITUTE

UNPUBLISHED manuscripts, inaccessible periodicals, and important translations are now available for research workers through new services offered by American Documentation Institute and certain important libraries. This group of agencies has arranged convenient facilities for making available at a nominal cost both unpublished and rare printed material.

Microfilms of published periodical articles are now available from about a dozen of the largest libraries at a flat fee of 50 cents per article. This service was originally rendered only by the Bibliofilm Service at the Library of the U. S. Department of Agriculture, Washington, D. C.

When ordering reproductions of articles the fee of 50 cents should be sent with the order. If the library first addressed does not have the original available, it will forward the order and fee to one of the others of the group believed to have the material for photographing.

Unpublished manuscripts of important nature are also received by A.D.I. from responsible cooperating editors of scientific journals. These journals must publish an abstract or a notice of the existence of the manuscript. The manuscript itself is then available from A.D.I. at a nominal charge in microfilm or photoprint form. A similar service is being arranged for microfilm reproduction of manuscript translations of important foreign articles.

PACKAGING CONFERENCE AND EXPOSITION AT CHICAGO

EXHIBITS of wartime packaging, packing, and shipping, together with developments which will be available after the war, will be on view at the 14th Annual Packaging Exposition sponsored by the American Management Association, to be held at the Palmer House, Chicago, March 28–31. Packaging machinery and equipment and packaging, packing, and shipping supplies for wartime and postwar uses will be on display. Featured will be a clinic for packagers supplying the armed forces.

Concurrent with the exposition, the Association's Annual Packaging Conference will be held, with speakers from government and industry. Changes in government specifications for overseas packing, postwar uses of wartime substitutes, trends in merchandising that will affect packaging in the postwar period, the re-use of containers and paper conservation will be among the topics. There will also be a technical session devoted to package testing, and bulk packing versus individual packaging will be considered. In addition, there will be an address on the organization and operation of a packaging department.

PLASTICS ENGINEERS PLAN CHAPTER FOR TOLEDO

MOVING over to Toledo, Feb. 18, Detroit Chapter of the Society of the Plastics Engineers, Inc. met their Toledo members with plans for setting up a separate chapter in that city. Chairman of the Toledo organizing committee is G. W. Clarke of Owens-Illinois Glass which also provided the guest speaker, Oscar Burch. His subject was "Glass, A Thermoplastic Material." W. B. Hoey, national vice-president of S.P.E. followed the speaker with a talk on the aims and purposes of the Society. Over 100 men, including a generous representation from Toledo's many research laboratories, attended the dinner. Earlier in the day the national S.P.E. Board, under President Charles C. Henry, met the officers of Detroit and Cleveland Chapters and the National Affiliate Council. Because of George C. Gress's resignation due to ill health, John H. Deer, general manager of Sinko Tool and Manufacturing Co., Chicago was elected secretary-treasurer of the Board to fill out the unexpired term. A. H. Voss, Western Electric Co., Cicero, was appointed chairman of the general committee of technical activities and J. F. Calef, Automatic Electric Co., Chicago, accepted the vice-chairmanship of this group.

ELECTROCHEMISTS WILL MEET IN MILWAUKEE

THE ANNUAL meeting of The Electrochemical Society, Inc., will be held in Milwaukee, April 12-15 with headquarters in the Pfister Hotel. Registration will open on the evening of April 12 and the annual business meeting, including tellers report on the election of new officers, will take place on the following morning. The annual banquet will be held in the evening when Dr. R. M. Burns will deliver the presidential address. There also will be the bestowal of honorary memberships and the presentation of the young author's cash prize and the young author's book prize. On the evening of April 14 there will be an informal reception to the new officers followed by a complimentary buffet supper and entertainment with Pabst Brewing Co. as host. The luncheon on April 15 will be in honor of the newly elected president of the Society.

Following the business meeting, the technical sessions will get under way with electrolytic cells as the first topic of discussion. In the afternoon the talks will center on powder metallurgy and on the morning of April 14, the program calls for discussion on miscellaneous electrochemical topics. Sessions on corrosion will open on the afternoon of April 14 and will continue throughout the following day.

SOCIETY FOR METALS SPONSORS RESEARCH ON CORROSION

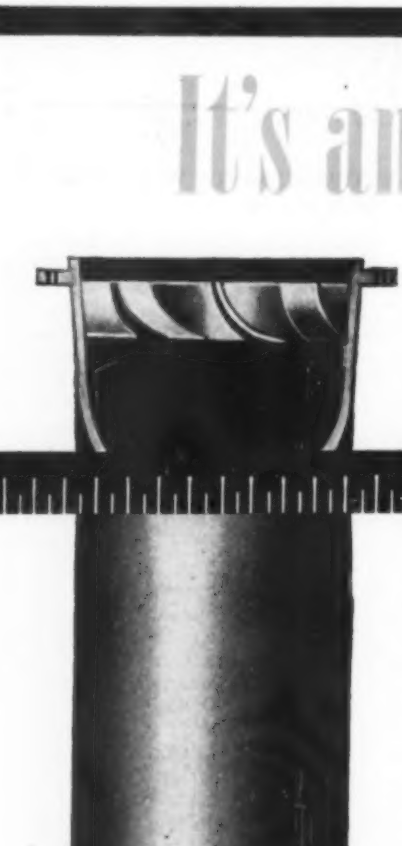
PLANS HAVE been completed whereby the American Society for Metals will provide an annual fund of $1,000 for the support of fundamental research in the field of corrosion. A committee has been formed under the chairmanship of Dr. R. M. Burns, assistant chemical director, Bell Telephone Laboratories, New York, and including T. S. Fuller, General Electric Co., Dr. F. W. Adams, Pittsburgh Plate Glass Co., and Dr. H. L. Maxwell, E. I. du Pont de Nemours Experimental Station. This committee will select such research projects as appear worthy of support, approve the qualifications of applicants for grants-in-aid, and certify to the Society the names of successful applicants.

VANCE T. EDWARDS CHOSEN TO HEAD TAPPI

THE Technical Association of the Pulp and Paper Industry held its 29th annual meeting in New York Feb. 14–17. Vance T. Edwards was elected president to succeed Ralph A. Hayward who had served during the past two years. Mr. Edwards is with the International Paper Co. at Palmer, N. Y. The newly elected vice-president is G. W. E. Nicholson of Union Bag & Paper Corp., Savannah, Ga.

Allen Abrams, past president of the association, presented the TAPPI medal to D. C. Everest, president of Marathon Paper Co.

It's an engineering fact . . .



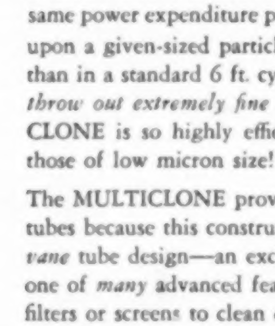
This 9" MULTICLONE TUBE has *8 times* the dust separating power of a 6 ft. cyclone chamber!

IN RECOVERING dusts, fly ash and other suspended particles from gases, it is a basic engineering law that the separating efficiency of a cyclonic collector tube *in*creases as the tube diameter *de*creases. For example, with the same power expenditure per cubic foot of gas treated, the separating force acting upon a given-sized particle is *8 times greater* in a 9 in. MULTICLONE tube than in a standard 6 ft. cyclone chamber . . . *8 times greater cleansing power to throw out extremely fine as well as coarse particles.* This is why the MULTICLONE is so highly efficient in recovering ALL types of suspensions, even those of low micron size!

The MULTICLONE provides the high recovery efficiencies of *small* diameter tubes because this construction is made practical by the simplified inlet of the *vane* tube design—an exclusive MULTICLONE development. Yet this is just one of *many* advanced features incorporated in the MULTICLONE. It has no filters or screens to clean or replace, no high speed moving parts to repair or maintain, nothing inflammable to burn or char. It is extremely compact, is easier to install, and is ruggedly built for years of heavy-duty service!

VG MULTICLONE TUBE
Cross section shows patented vane which guides gases.

WHY SMALL TUBES ARE MORE EFFICIENT!



Every automobile driver knows that a car will safely negotiate a wide turn . . . yet will turn over if forced around a sharp turn at the same speed. Why? Because centrifugal forces rapidly increase as the turning radius decreases. This same principle explains why the small MULTICLONE tube is a far more efficient dust separator than the conventional large cyclonic tube. The sharp radius of the small diameter MULTICLONE tubes sets up much higher centrifugal forces—therefore has far greater separating action—than has the large radius of conventional cyclone tubes. This is why the MULTICLONE separates extremely fine as well as coarse particles with high efficiency!

36 years of specialization in recovering suspensions—starting with the first commercial application of COTTRELL Electrical Precipitation—is behind the MULTICLONE. Let this experience assist you in the efficient solution of *your* particular recovery problem!

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SUPERPHOSPHATE PRODUCTION MOVES UPWARD

The War Production Board has announced that superphosphate requirements for 1944-45 have not been definitely established. The 1943-44 program provided for production of 7,000,000 tons of the fertilizer. It is estimated that by the first of the 1944-45 season, operations will be at the rate of 8,000,000 tons of superphosphate a year, estimated minimum requirements for the year are 9,000,000 tons, however.

A report on WPB-authorized acidulating plants which are under construction has been given to WPB's Inorganic Acids Industry Advisory Committee. The plant at Searsport, Maine, is expected to be in operation by June, while the acid portion of the project at Pocatello, Idaho, has been suspended until certain facts in respect to another plant are clarified. If sulphuric acid production capacity is increased at Garfield, Utah, which is a waste gas operation, the acid unit at Pocatello may be eliminated.

Members of the committee also were told that the triple superphosphate project originally planned for Beaumont, Texas, has been shifted to Houston. Of the 170,000 tons of superphosphate to be produced annually by this unit, only about 100,000 tons will be standard. The remainder will be triplephosphate. This plant is designed to operate on spent alkylation acid. Another acid plant which is expected to be in operation about April 1 is that of the American Agricultural Chemical Co. at St. Bernard, Ohio.

Distribution of ordnance acid to southeastern manufacturers in January was 25,000 tons equivalent to 19,000 tons on a 100 percent basis, while February distribution in the same area will be 26,500 tons. The program for the north is still somewhat indefinite. San Francisco superphosphate plants are now operating at only 50 percent capacity because of lack of manpower.

ACS WILL DISCUSS POSTWAR OUTLOOK FOR CHEMICALS

The postwar outlook for the chemical industry will be surveyed at a symposium to be held in connection with the 107th meeting of the American Chemical Society in Cleveland April 3 to 7. The chairman will be Dr. L. W. Bass, director of the New England Industrial Research Foundation.

Ralph E. Flanders, president of Jones and Lamson Machine Co., Springfield, Vt., and chairman of the research committee of the committee for economic development, will deliver an address on "Technology and Industrial Management." D. M. Sheehan, comptroller of the Monsanto Chemical Co., St. Louis, will analyze the accounting and financial problems which will confront the industry in the transition period. Dr. W. L. Badger of Ann Arbor, Mich., manager of the consulting engineering division of the Dow Chemical Co., will outline the needs for practical engineering to effect rapid commercial-scale development of new products. John B. Glenn, president of the Pan American Trust Co., New York, and vice-president of the New York Board of Trade and chairman of the Latin American Section, will outline the policies necessary to maintain our international leadership.

Raymond Stevens, vice-president of Arthur D. Little, Inc., Boston, will discuss the more extensive and effective use of fundamental and applied research which he foresees in the postwar period. Dr. H. S. Rogers, president of the Polytechnic Institute of Brooklyn, will interpret the trends in technical education, with special reference to chemists and chemical engineers.

FAT AND OIL SUPPLY WILL INCREASE IN 1944

Total production of fats and oils from domestic materials in the calendar year 1944 may be about 11.2 billion pounds compared with 10.8 billion pounds in 1943. Stocks on January 1, 1944 were moderately higher than a year earlier and imports are expected to increase in 1944. Hence, the total supply of fats and oils in the United States will be substantially larger this year. Little change is likely, however, in supplies available for civilian consumption. With an increased number of men in the armed forces, military takings will expand. Exports of fats and oils under lend-lease are expected to increase.

CONVENTION CALENDAR

American Gas Association, war conference on industrial and commercial gas, Hotel Seneca, Rochester, N. Y., March 30–31.

American Society of Mechanical Engineers, spring meeting, Birmingham, Ala. April 1–3.

The American Ceramic Society, Inc., second war conference, Hotel William Penn, Pittsburgh, Pa., April 2–5.

American Chemical Society, 107th meeting, Cleveland, Ohio, April 3–7.

The Electrochemical Society, spring meeting, Milwaukee, Wis., April 12–15.

American Institute of Chemical Engineers, semi-annual meeting, Hotel Cleveland, Cleveland, Ohio, May 14–16.

American Association of Cereal Chemists, annual meeting, Nicollet Hotel, Minneapolis, Minn., May 23–25.

American Society for Testing Materials, annual meeting, Waldorf-Astoria, New York, N. Y., June 26–30.

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Getting a LIFT with a Stearns MAGNET

Assembling this 4000-lb. track would be a tough job without Stearns Lifting Magnets. This is only one of many applications for Stearns magnets that help speed production in busy war plants.

Moving large quantities of material in fast time at low cost—guarding hand labor on difficult and dangerous operations, conveniently, safely and economically.

Increasing storage capacities, loading and unloading are a few of the advantages of using Stearns Lifting Magnets.

Let Stearns magnets give you a lift. We make 'em in many sizes and shapes. Why not consult Stearns Magnetic Milwaukee with your problem.

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PRICE ADJUSTMENT BOARD FOR WAR CONTRACTS

At its first meeting, held February 26, the new War Contracts Price Adjustment Board, created by the renegotiation section of the Revenue Act of 1943, which became law on February 25, 1944, established its organization.

The personnel of the new board, appointed by the heads of the agencies involved, is as follows: Joseph M. Dodge, chairman of the War Department Price Adjustment Board, chairman; Laird Bell, chairman of the Navy Price Adjustment Board, vice chairman; Commander Arthur G. Rydstrom, Maritime Commission Price Adjustment Board, who is also representing the War Shipping Administration Price Adjustment Board; Captain Harry C. Maull, Jr., chairman of the Treasury Department Price Adjustment Board; Charles T. Fisher, Jr., chairman of the Reconstruction Finance Corporation Price Adjustment Board, and Carman G. Blough, War Production Board representative. W. James MacIntosh has been appointed general counsel to the War Contracts Board.

The authority of the board applies to renegotiation for war contractors' fiscal years ended after June 30, 1943, while authority of the Joint Price Adjustment Board—established last October by voluntary action of the various individual departmental boards—applies to war contractors' fiscal years ended before July 1, 1943.

RECORD OUTPUT OF PRIMARY ALUMINUM LAST YEAR

The War Production Board revealed last month that primary aluminum output in 1943 exceeded 1942 production by over 75 percent and amounted to over 1,800,000,000 lb. Peak production for the year, and probably for the duration of the war, was reached in the last quarter when production averaged more than 185,000,000 lb. a month. Aluminum recovered from secondary sources exceeded 500,000,000 lb. for 1943 and reached a peak of 55,000,000 lb. in December.

December primary and secondary production was almost three times as much as in January 1942, the first month after Pearl Harbor. In addition to domestic production, the United States had available from Canada 262,800,000 lb. of primary aluminum in 1942 and 428,700,000 lb. in 1943.

POWER CONFERENCE WILL DISCUSS WAR PROBLEMS

Twenty-four speakers are scheduled to address this year's Midwest Power Conference, according to the preliminary program for the 1944 meeting which has just been announced by Illinois Institute of Technology. The third wartime meeting of the conference—and the seventh annual under its present sponsorship—the 1944 session will be held April 13 and 14 at the Palmer House in Chicago. Co-operating with Illinois Tech in arranging the event are eight other colleges and eight engineering societies.

The conference will emphasize both war and postwar power problems.

SIGMA XI HONORS ESSO RESEARCH CLUB

The Society of the Sigma Xi, national scientific honor society, founded at Cornell University in 1886, with local members organized as chapters or clubs in about 125 American universities and colleges, is extending the fulfillment of its organic purpose of the "Encouragement of Original Investigation in Science, Pure and Applied" by encouraging member group activity in non-academic research institutions which qualify because of their participation in, and encouragement of, original research in science.

The first industrial research group to qualify and be granted affiliation with Sigma Xi is the Esso Research Club, of Elizabeth, N. J., whose membership is drawn from the chemists, physicists, engineers, and other technical research and development personnel of the companies associated with Standard Oil Company (N. J.). Arrangements are being made for the installation of the Esso Research Club by the national officers of Sigma Xi on April 26.

CHATTANOOGA MAY BE SITE FOR NYLON PLANT

Announcement has been made by E. K. Gladding, manager of the nylon division of E. I. du Pont de Nemours & Co., Inc., that a site near Chattanooga, Tenn., is being considered by his company as a site for a postwar nylon plant. He said that options had been obtained on tracts of land on the north side of the Tennessee River northeast of Chattanooga, below the TVA power project. The proposed plant would be comparable in size to the Martinsville plant. Mr. Gladding further said that the plants at Seaford, Del., and at Martinsville, Va., would be materially expanded.

REICHHOLD RESEARCH WORK CENTERED AT DETROIT

Research activities of Reichhold Chemicals, Inc., recently have been greatly expanded and reorganized. Personnel in the company's laboratories has been enlarged about 25 percent in the last few months and all research has been centralized at the main plant in Detroit. John J. Bradley, Jr., is director in charge of research. The work has been divided into seven distinct units with A. G. Hovey in charge of research on coating resins; Harry Kline on phenol plastics; Arthur C. Lansing on chemicals; Harold E. Weisberg on chemical pigments; A. G. Hovey on patents; J. Frank Maguire on market research; and Dr. E. F. Siegel on special compounds.

NEW DU PONT PLANT TO MAKE LUMINESCENT CHEMICALS

Construction started on March 1 at Towanda, Pa., on a new plant for the Patterson screen division of E. I. Du Pont de Nemours & Co., Inc. The Patterson Screen Co., acquired by du Pont last July, has pioneered the manufacture of fluoroscopic and x-ray intensifying screens and will use the new facilities for the production of luminescent chemicals.

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*corrosion control

PROOF

A solid steel bar half-coated with CO-RES-CO. After 20 days partially immersed in 10% *nitric acid* — more than half the unprotected steel was eaten away. The CO-RES-CO coated portion remained *unaffected.*

Data

For busy plant executives and engineers:

CO-RES-CO IS A PLASTIC solution in a hydro-carbon vehicle. And — *plastics do not corrode.*

CO-RES-CO DOES NOT OXIDIZE. It is *not* a paint. It demonstrates many times greater resistance to severe acid, alkali, salt spray and to general weathering than can be expected from any of the oxidizing paints.

CO-RES-CO EMPLOYS NO DRYERS. (To whatever extent dryers are used in the paint film, the paint is weakened exactly to that extent.)

CO-RES-CO IS WIDELY USED. It is an accepted method of corrosion control in many industries and official government departments.

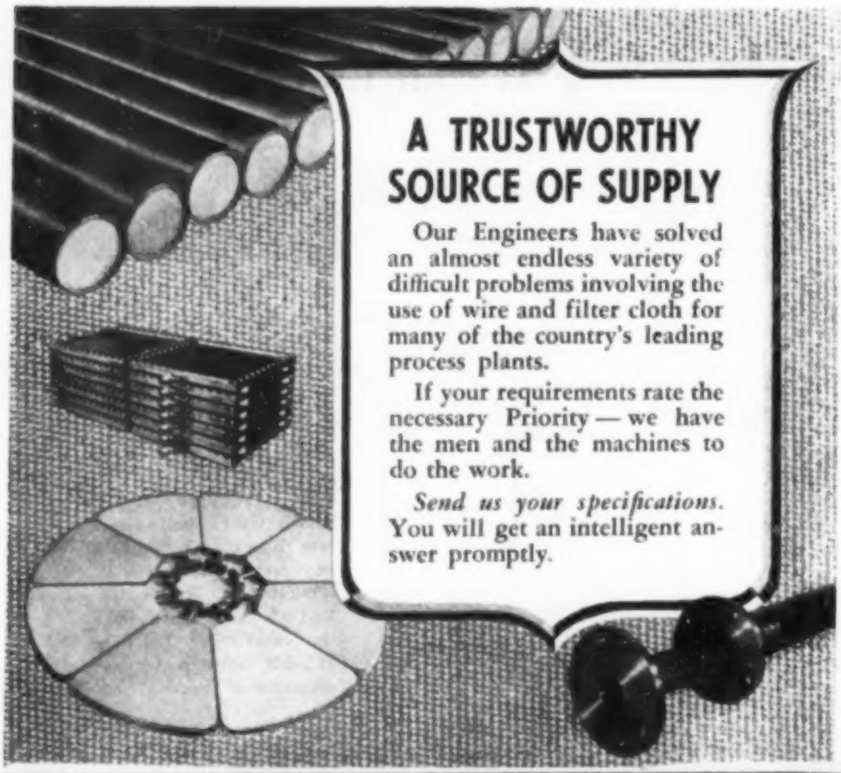
WRITE for further data, giving details of your corrosion and maintenance problems for specific analysis.

CORDO CHEMICAL CORP., Norwalk, Conn.

(Formerly: Corrosion Control Corp.)

CO-RES-CO

THE PLASTIC CORROSION RESISTANT COATING



A TRUSTWORTHY SOURCE OF SUPPLY

Our Engineers have solved an almost endless variety of difficult problems involving the use of wire and filter cloth for many of the country's leading process plants.

If your requirements rate the necessary Priority — we have the men and the machines to do the work.

Send us your specifications. You will get an intelligent answer promptly.

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GARRISON AVE., BRONX BORO, N. Y.

WIRE CLOTH
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ALL MESHES
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Roasting Recovers Valuable Materials

FILTER AIDS—Bethlehem Roasters are used to burn off the impurities in wet diatomaceous muds and fuller's earths, and return them to process with high filtering efficiencies.

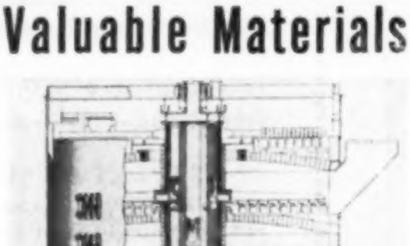
CALCIUM OXIDES recovered by roasting from waste lime muds. No interruption of operations. Recoveries of 95% in terms of CaO.

CHEMICAL WASTES and sludges treated for uniform recovery of a premium-priced by-product.

A HIGH GRADE PIGMENT continuously produced in a Bethlehem Roaster, with a Bethlehem Experimental Roaster operating as a processing guide.

Since it first went to work burning pyrites for an acid plant in 1907, the Bethlehem Wedge Roaster has wrought many production benefits in chemical industries, as well as in the treatment of ores and concentrates.

Continuous operation, complete control of temperature and time factors, control of gaseous and solid products of reaction, ease of operation, low maintenance costs, and other desirable operating features, account for this diversity of successful applications.



How Bethlehem Wedge Roasters save process materials for RE-USE and recover valuable BY-PRODUCTS.

Write for Catalog CM-34 for more facts about the Bethlehem Wedge Roaster. The catalog also describes Bethlehem Thermocoil kettles, nitrators, reducers, sulphonators, vacuum stills, autoclaves, and other processing equipment.

BETHLEHEM FOUNDRY & MACHINE COMPANY
Bethlehem, Pa.

QUALITY OF PAINTS PRAISED BY WPB OFFICIAL

LAST MONTH, at the meeting of the New England Paint, Varnish and Lacquer Association, B. M. Belcher, chief of the paint, varnish and lacquer unit of the War Production Board, vigorously denied that the quality of trade sales paints had been degraded as a result of the enforced use of substitute materials. He admitted that the changing raw material situation which started prior to the war has forced the paint manufacturer to make changes in the formulation of his various products. He referred to the lack of certain resins and oils as a factor in changing the characteristics of paints and said the present non-availability of colors will further affect the situation.

Mr. Belcher expressed the opinion that paints supplied by manufacturers today are perfectly adequate for the job at hand, which is the protection of property. He further said no evidence was at hand to substantiate the charge that paints have been degraded as a result of Order M-332 while evidence based on laboratory and field tests indicates that paints made under the order are equal to, and in some cases superior to those made under formulating methods prior to the war.

CHEMURGIC CONFERENCE WILL BE HELD AT ST. LOUIS

THE TENTH annual chemurgic conference, held under the auspices of the National Farm Chemurgic Council, Inc., will convene at St. Louis on March 29 for a three-day session. Included on the program for the opening day is a plastics session at which the speakers will be W. E. Parsons, Keyes Fibre Co., Waterville, Maine; Robert Haines, The Dow Chemical Co., St. Louis; P. W. Griffith, American Cyanamid & Chemical Corp., Azusa, Calif.; J. H. DuBois, General Electric Co., Pittsfield, Mass.; and Thomas D. Perry, Resinous Products & Chemical Co., Philadelphia.

The morning session on March 30 will be given over largely to discussions on fibers with papers to be presented by Dr. W. E. Coughlin, Celanese Corp. of America, New York; R. Boyer, The Drackett Co., Cincinnati; and Theodore Marvin, Hercules Powder Co., Wilmington. Among the speakers listed for the closing day is Philip A. Singleton, New England Alcohol Co., Boston, who will discuss the importance of Caribbean molasses in the alcohol program.

WESTERN NEW YORK SECTION AICHE ELECTS OFFICERS

CLARK B. SHEPHERD, assistant manager of new-process development for the electrochemicals department of E. I. du Pont de Nemours & Co., Inc., Niagara Falls, was installed as chairman of the western New York Section of the American Institute of Chemical Engineers in Buffalo, on Feb. 24. Other officers are: vice-chairman, Guy N. Harcourt of Buffalo; secretary-treasurer, Allan G. Hamilton of Niagara Falls. L. J. Murphy of the Westinghouse Electric & Mfg. Co., addressed the meeting.

BARITE SHORTAGE AFFECTS BARIUM CHEMICALS

PRODUCTION of barite has declined markedly in the face of recent increases in requirements. Stimulation of its production is one of the most pressing problems confronting the War Production Board. The short position of the barite stockpile adversely affects production of barium chemicals, lithopone, glass, and ground barite used in well drilling.

At the beginning of the war there were many small producers in operation and there was a large stockpile of imported material on hand. The situation apparently being well in hand, producers of barite were placed below coal and solid metals when it came to priorities for both equipment and manpower. Most barite mines are in low wage areas with the prevailing scale for common labor about 40 cents an hour with rates ranging up to 80 cents an hour for truck and tractor drivers and gig men. Barite mines soon lost their men to higher paying war industries.

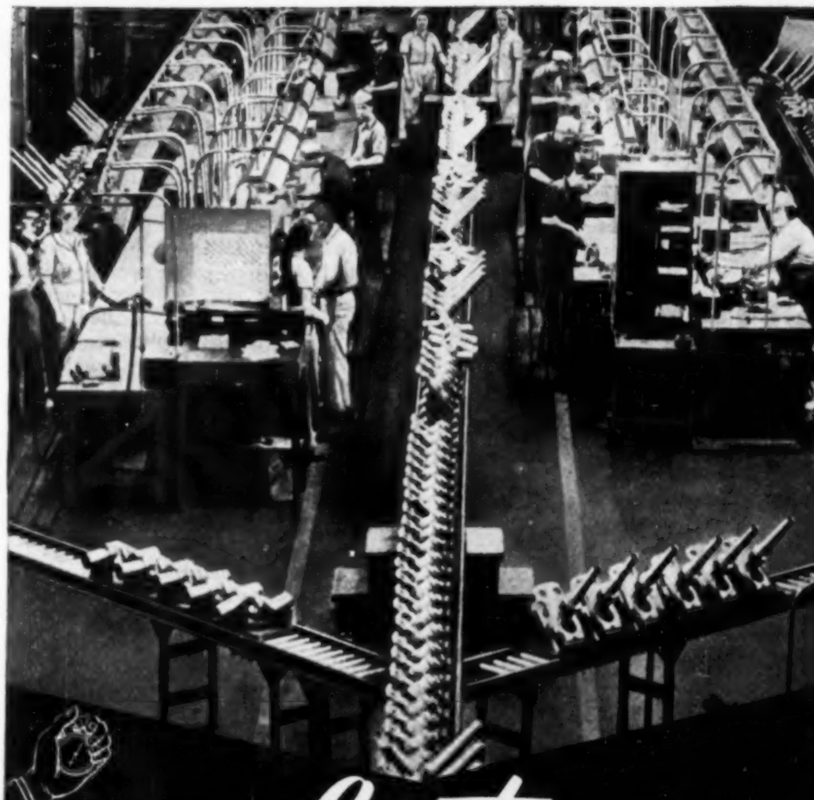
Late last fall requirements for barite increased rapidly. It will be recalled that in 1942 government policy was to curtail drilling for oil. In the last half of 1943 that policy was abandoned and a tremendous amount of drilling was undertaken at the request of the Petroleum Administrator. It was the unusual demand for drilling mud that brought the barite supply situation to light.

Efforts to increase production followed. New mines in Arkansas came into prominence because of their proximity to the oil fields. In many other sections of the country deposits of barite in commercial quantities have been found. The Arkansas deposits are displaced shale which is separated by fine grinding and flotation. Ceiling prices were set on the Arkansas production to assist in channeling its movement to the oil fields. Ground barite for drilling mud was given a higher ceiling than chemical grades and producers found themselves selling material from the same bin for different prices depending upon the end use. The price differential was effective in getting producers to sell their barite for drilling mud but a further distortion of the supply followed and but little improvement is expected until fall.

DU PONT RENEWS FELLOWSHIPS FOR CHEMISTRY RESEARCH

AWARD of 22 postgraduate fellowships for research in the field of chemistry for the academic year 1944-45 has been announced by E. I. du Pont de Nemours & Co., Inc. Appointments of these fellowships, which amount to $750 each, will be made later in the year by the heads of the chemistry departments of the several colleges and universities to which grants have been made.

Fellowships for advanced work in chemistry were established by the du Pont company in 1918, when there was a scarcity of well trained chemists. Through the Fellowship plan the company seeks to encourage promising students to follow a career in chemical research. Women are admitted to candidacy on the same basis as men.



TIMING *Counts* on the Production Front

. . . controlling the flow of material saves man-hours and makes certain that delivery schedules will be met

On the playing fields of sport—and on the field of battle — success depends on *timing*, rhythm of motion. Timing is a vital element in production, too.

Having the right material at the right place at the right time — just enough of it and not too much — is a characteristic of efficient production.

Keeping production synchronized — timed — involves planning all along the line, to relieve congestion at one point, speed up movement at another, to the end that goods will be produced with precision and speed, and at an economical cost.

Conveyor engineering, applied like Standard does it, accomplishes all these things. If you feel that *timing* could be improved in your plant — check with Standard.

"Conveyors by Standard" — Catalog No. CM-3 is yours for the asking. Why not write today?

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ENGINEERED FOR FASTER PRODUCTION

SPEED UP your DRYING NOW!

IT CAN BE DONE IN MOST INSTANCES. But it means better and mor. EXACT DESIGN and perhaps HIGHER TEMPERATURES.

ROSS DRYERS

FOR CHEMICAL PRODUCTS

embodying the use of ROSS Air Heaters direct or indirect, oil or gas fired, will give you the needed EXTRA heat, the required EXACTING control—the greater SPEED with absolute SAFETY. Four major essentials in a single system.

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The ROSS Laboratory is one of the finest in equipment and facilities for determining correct conditions for treatment of your product.

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NEWS FROM ABROAD

POSTWAR DEMANDS OF BRITISH AGRICULTURE MAY INCREASE USE OF FERTILIZER CHEMICALS

Special Correspondence

Problems of fertilizer production have attracted special interest in British chemical quarters, partly because the wartime needs of increased food production in the country have accentuated the importance of regular replacement of fertilizer elements withdrawn from the soil, and partly because the postwar demands of British agriculture promise to open an outlet for chemical trades which are now concentrating on the production of explosives and other means of warfare. Apart from this, it is realized that after the war many overseas countries, especially in the colonial territories, will require larger supplies of chemical fertilizers to make up for shortages during the war and to make possible more intensive methods of agriculture.

Unfortunately Great Britain is not favorably placed with regard to chemical fertilizers. There are no deposits of potash or phosphates in the country, and the sources of hydroelectric power for the production of synthetic nitrogen compounds are limited and not yet fully developed. As far as potash is concerned, wartime supplies are mostly of United States, Spanish and Russian origin, but the Russian product often arrives in a rather damp condition, with consequent trouble in operations, so that manufacturers prefer United States potash salts. Russia also supplies England with apatite concentrates, and another important source of phosphates has been opened up with the occupation of North Africa. As far as sulphur is concerned, all supplies for England are still reported to come under lend-lease arrangements from the United States, while Spain is covering British requirements of pyrites. No information is yet available with regard to Sicilian sulphur. But since the Mediterranean is now open to Allied shipping, it may be expected that Sicilian sulphur, Palestinian potash and other chemical raw materials from that region will play a more important part in meeting British needs.

While the importance of potassium and phosphorous for fertilizing is not underrated, the authorities have been compelled to concentrate on the provision of increased tonnages of other fertilizer materials. Vast quantities of lime have been supplied to farmers, and the consumption of ammonium sulphate and other nitrogen compounds reached an all-time record in 1943. Since supplies are smaller than demands, it has been necessary to restrict their use to applications where they give best re-

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—the right size, type, material, drive? . . . If not, *we're sure to have the right one.* We've been making pumps for over a quarter of a century, and can supply pumps for every process need. Available in stainless steels, acid-resistant bronzes, nickel, lead or any required alloy; in horizontal or vertical types and in any combination of single or double suction and single or multi-stage; in direct connected, belted, chain or geared drives. Of rugged construction—guaranteed to meet the conditions for which they are sold. Call on us next time you need pumps for process work.

THE Frederick IRON & STEEL CO.
Frederick, Maryland

sults. Balanced fertilizers have been introduced, and certain compounds are supplied only for use on certain crops. Such wartime measures are however temporary, and there is no doubt that British farmers have become fertilizer-conscious, while systematic wartime tests have shown the vast scale of the need for chemical fertilizers to obtain optimum results.

For postwar days continued progress on wartime lines is anticipated. More attention than ever will be devoted to the way in which chemical fertilizers are to be applied. Granulation has made great advances, and may indeed be required on a large scale to overcome the farmers' prejudices based on the unattractive form in which fertilizers usually reach them. Another feature which is likely to attain increased importance is the standardization of chemical fertilizers, especially of compounds. Both developments—granulation and standardization—help to reduce the storage problem which has caused some difficulties in British fertilizer manufacture and application.

INTERNATIONAL CONTROL

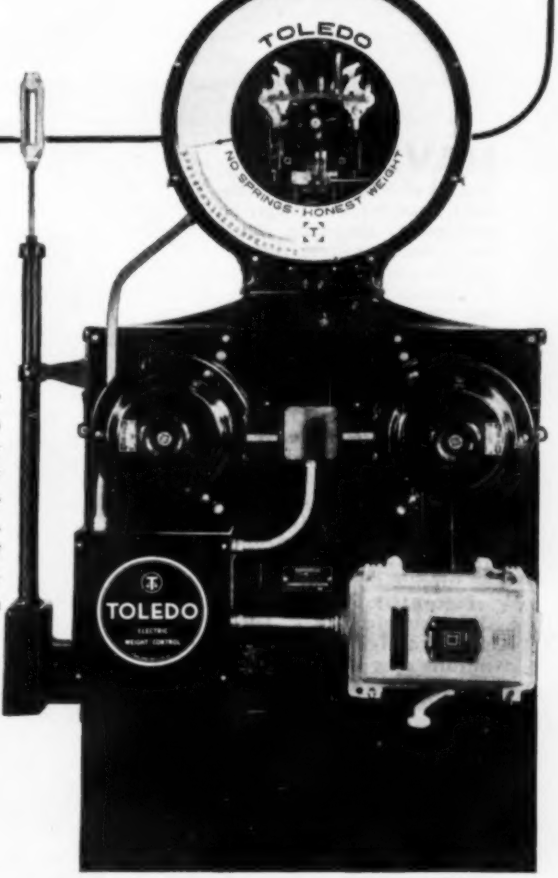
While a steady expansion of fertilizer consumption in overseas countries is expected after the war, British fertilizer interests believe that international market control will be necessary to avoid the evils of overproducion and excessive competition. In the case of potash the export markets were before the war controlled by the German-French-Polish cartel, and a limitation and regulation of potash exports from Continental Europe also may be necessary after the war. In the case of phosphates the supply position will of course depend to a large extent on the position in the Pacific and shipments from Nauru and Christmas Islands, etc. As far as nitrogenous fertilizers are concerned, some control was exercised by the European cartel, which cooperated with the Chilean export organization, but in future this arrangement is unlikely to prove sufficient unless agreement is reached with the United States and Canadian producers. Yet, systematic market development should permit a vast expansion of sales. For India, for instance, it is estimated that the prewar consumption, which has fallen to less than one-third during the war, could be trebled or quadrupled.

Present production of sulphuric acid in Great Britain is estimated by P. Parrish at over 2,000,000 long tons a year. The output of spent oxide has reached about 220,000 tons (equal to about 100,000 tons of sulphur), and something like 120,000 tons of 70 percent acid is being made from anhydrite. These figures reveal a considerable increase over prewar tonnages.

No further information has been received about the synthetic rubber project of British Celanese Ltd. At the annual meeting of the company's shareholders the chairman confined himself to the remark that "we have been active in this field for many years, and all the known synthetic rubber products, and many up till now unknown, will be produced by us". The company has usually preferred its own counsels, and reports substantial progress also in the field of synthetic fibers. It states that it is now able to produce fibers with a strength of 11 grammes per

Buxom Bertha

KNOWS HER BATCH CONTROL



Our Engineers dubbed her "Buxom Bertha." In glass plants where she works they know how deft her hand, how keen her eye, how efficient her control in the automatic high-speed low-cost batching of multiple ingredients. They love her for her superlative accomplishments.

A TOLEDO *CONTROL* INSTRUMENT

● Toledo Scales weigh-count-measure-*control* both fluids and solids. So doing, they monitor production and accumulate Control Facts which are vital to the maintenance of quality and the accurate determination of costs. They are the Silent Sentinels of Production.

Behind their quiet efficiency stands TOLEDO RESEARCH —the coordinated activity of the largest engineering-research group in the scale industry.

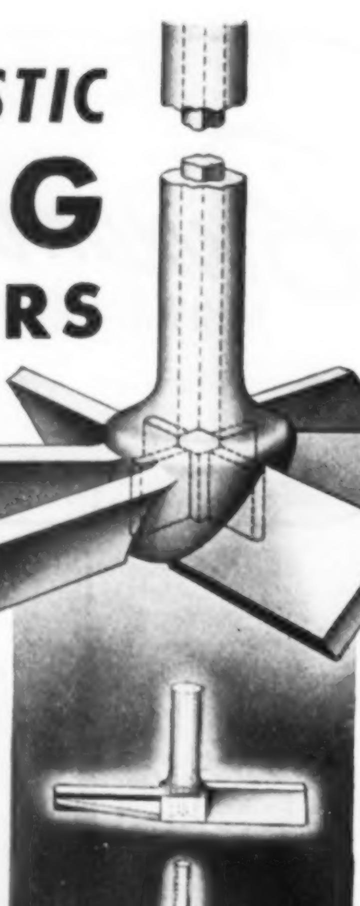
Toledo Research, prewar, had up its sleeve many developments in the fields of applied electronics and optics, which have helped to make War Things better, and faster.

Toledo Research, postwar, will help build a better world through the more accurate and rapid measurement and control of materials . . . Toledo Scale Company, Toledo, Ohio.

TOLEDO SCALES

TIP FOR TOMORROW ***PRINTED Weight Records will become universal in Industry, postwar. Hundreds of war plants are using them. We are at liberty to send you complete information now.***

MOLDED *PLASTIC* HAVEG AGITATORS



HAVEG *itself* is acid- and alkali-resistant throughout its entire mass. It may be molded to shape on metal shafts without involving expensive molds. Four standard types of agitators are illustrated. These are typical of the almost infinite variety of designs and types of agitators which can be molded from HAVEG.

Figure 104: This integrally molded pitched blade agitator for relatively high shaft speeds is usually supplied in diameters up to 2′ 6″.

Figure 103: A plain, slow-speed, integrally molded, single-bladed agitator which is satisfactorily used for agitating free-flowing liquids and thin sludges. The blades can be supplied pitched or vertical.

Figure 105: HAVEG Agitator with demountable blades. A highly desirable design where abrasive conditions may make it necessary to replace blades. This type of blade may also be used to add blades to an agitator already in service.

Figure 106: A heavy-duty HAVEG Agitator. Has vertical double blades, thoroughly braced. They are also demountable. This type agitator has been made up to 6′ in diameter.

FIG. 104

FIG. 103

FIG. 105

FIG. 106

METAL SHAFTS—HAVEG COVERED

In all types of HAVEG Agitators the shaft itself is made of metal—and covered with HAVEG. This HAVEG covering is free to expand and contract. The positive method of attaching the HAVEG at the bottom is clearly shown in the illustrations. The blades themselves are always solid HAVEG.

HAVEG Bulletin F-3 gives complete engineering, design and application data on all types of HAVEG equipment. Tanks, Towers, Pipe Fittings, Fume Duct and many others. Send for a copy.

HAVEG-SARAN *Tubing; Pipe & Fittings; and sheets are available from stock.* **HAVEG-SARAN** *is also described in Bulletin F-3. Send for a copy now.*

HG-43

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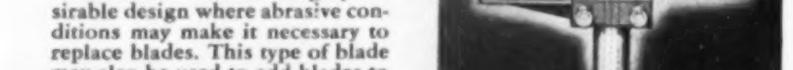
NEWARK, DELAWARE
FACTORY–MARSHALLTON, DELAWARE



CLEVELAND 550 Leader Building · CHICAGO 1201 Palmolive Building · DETROIT 2832 E. Grand Blvd · LOS ANGELES 601 W. Fifth St.

denier, compared with previous values of 6 to 7 grammes and 4 to 6 for nylon. The company is "busy on many other completely synthetic products, including those made from coal and hydrogen, with or without nitrogen" which may also be used in the textile industry for certain specific purposes. British Celanese thinks that it will be in a position to produce them as the need arises on the basis of its own processes. In this connection the company is arranging to produce all the intermediate chemicals needed for such final textile or other products, independent of any agreements of international character.

The field of synthetic resins is attracting increased attention also from the paint industry. One of the leading paint manufacturers, Lewis Berger and Sons Ltd., has formed a subsidiary, Berger Plastic Developments Ltd., to concentrate on this field of activities which "taking a long view, will provide additional earning capacity". The company reports that it has increased its production capacity in the paint field by attention to new methods and improved technique. As a result the production in factories of the parent company reached a volume greater than the previous high level established last year. Successful special investigations were carried out last year for certain government departments.

The leading British producers of zinc pigments have formed the Zinc Pigment Development Association to encourage and develop the uses, actual and potential, of their product, particularly by making their properties and applications more widely known and appreciated. The association is non-commercial in character and stresses that it has no interest in price fixing or similar matters. It will work in cooperation with the Zinc Development Association. The list of founders contains the names of eight firms.

PENICILLIN SUPPLIES

Supplies of penicillin in Great Britain are still so small that "it is a sort of corpse raising drug at present", as Prof. Dr. H. W. Florey of Oxford University told the Royal Institution. Arrangements have been made by the Ministry of Supply to produce as much penicillin as possible, but for some considerable time to come the total supply will be insufficient even to meet the requirements of the Services so that none can as yet be released for civilian use.

Alkathene, the I. C. I. polythene produced by subjecting ethylene to extremely high pressures under carefully controlled conditions, is now used in the manufacture of cables and accessories, especially for high-frequency and high-voltage work where its resistance to water and chemical attack added to its electrical properties have proved very valuable. Small quantities of polythene added to waxes raise their melting point and reduce any tendency to cracking or flaking. Its good water resistance is recommended in connection with its use for wrapping material, especially for hot and humid atmospheres. Polyisobutylene may be used as a plasticizer in connection with polythene.

The large number of moth proofing agents brought out during the past twenty years has caused the Wool Industries Research Association to carry out a systemat

investigation into their merits. Triphenyl-dichloro-benzyl phosphonium oxide and similar products are believed to be the active constituents of certain agents which combine good moth-proofing qualities with fastness to washing. Many patented moth-proofers are substituted ureas in which the substituents are aromatic groups, e.g. diphenyl ether, containing chlorine and a sulphonic group to confer solubility. Since many of the recognized moth-proofing agents are aromatic compounds of high chlorine content, pentachlorophenol has been studied and found to give satisfactory results when suitably applied, although, like fluorides, it is substantially removed by washing. Material moth-proofed with formaldehyde, with hydrochloric or sulphuric acid to give the requisite pH, washed with cold water, and neutralized with dilute sodium carbonate, also showed good resistance to larva attack. While fluorine products in general suffer from the drawback of insufficient fastness to washing, improved results in this respect have been obtained with chromium fluoride with or without antimony fluoride, adjusted to leave the equivalent of 0.65 percent of chromium fluoride in the dried material. Claims for fastness to washing for fluosilicic acid used in conjunction with triethanolamine and aluminum sulphate and for impregnation with a solution of a fluosilicate of a polymeric nitrogen-containing substance seem not to have been examined.

The Ministry of Supply has advised motor vehicle users that there are now six brands of commercial anti-freeze mixture available which may be bought without restriction. The solutions must however be regarded as wartime substitutes and give reduced protection (down to 20 deg. F. only). Moreover, they have slightly corrosive action on solder, mild steel, aluminum and aluminum alloys which need not however affect the efficient running if manufacturers' instructions are followed.

Tetrahydronaphthalene is now being used in Great Britain largely as a substitute for turpentine and it is thought likely that it will remain a serious rival to natural turpentine after the war because of its greater solvent power and high flash point. Very large quantities of naphthalene are said to be converted into the tetrahydro derivative, according to the president of the Midland Section of the Coke Oven Manufacturers' Association.

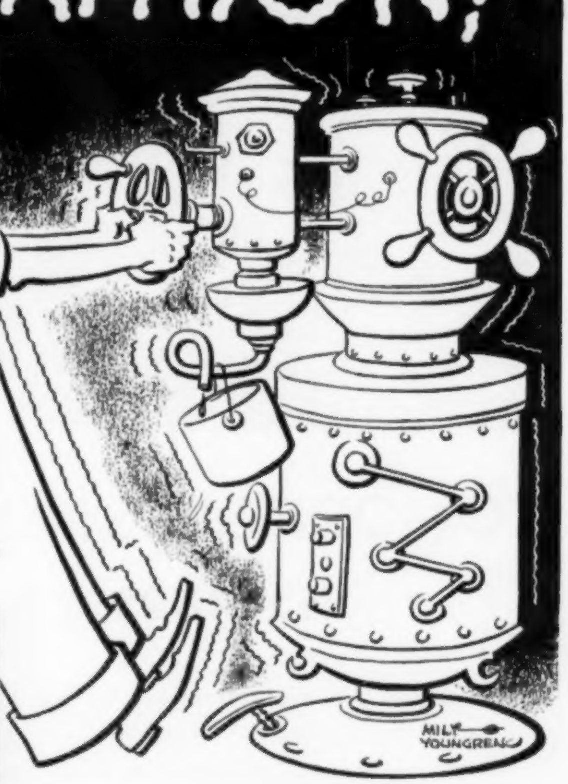
OUTLOOK FOR BABASSU AND CASTOR OILS IN BRAZIL

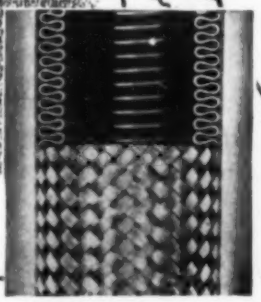
No APPRECIABLE quantities of babassu oil are expected to be available for export from Brazil in 1944, according to semi-official sources. During recent years babassu oil production in Brazil has not exceeded 7,000 metric tons, and stocks have been reserved almost entirely for domestic consumption. Moreover, relatively high prices for other oils have increased the use of babassu oil by the soap industry.

The Federal Council of Foreign Commerce recently publicized a proposed project for the increase of babassu oil production by using oil-crushing plants.

If the 1943–44 castor bean crop in Brazil is similar in volume to that of the

VIBRATION!





OUR ENGINEERS will recommend the type of flexible tubing most adaptable to these uses—

1. For conducting liquids from a vibrating to a stationary medium.
2. For high fatigue resistance under constant vibration.
3. For handling searching liquids without seepage.
4. For extreme temperature conditions.
5. For use where corrosion resistance is a factor.
6. For conducting liquids and gases to reciprocating parts.
7. For maximum flexibility with a minimum of length.
8. For dampening noise between two units that must have pipe connections.
9. For correcting misalignment.

REX-WELD Flexible Metal Hose CONTROLS IT

Chicago Metal Hose Corporation's REX-WELD is highly resistant to fatigue even when subjected to constant vibration over long periods of time. It is extremely flexible and remains air-tight and leakproof after years of hard usage. It stands up under high temperature and prolonged flexing. REX-WELD is fabricated from strip metal and is precision autogenous welded to form a weld stronger than the tube itself. Write, giving complete information and we will be glad to furnish engineering recommendations for any design problem.

Flexible Metal Hose for Every Industrial Use

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via MORRIS Pumps

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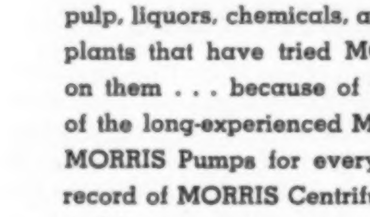
Today . . . as for two generations . . . MORRIS Pumps have made records of economy and efficiency in handling heavy pulp, liquors, chemicals, and clear water. Mills and chemical plants that have tried MORRIS Pumps quickly standardize on them . . . because of the authoritative recommendations of the long-experienced MORRIS engineers, the large line of MORRIS Pumps for every type of service, and the 80-year record of MORRIS Centrifugal Pumps for trouble-free service and low operating costs.

Write for Bulletin



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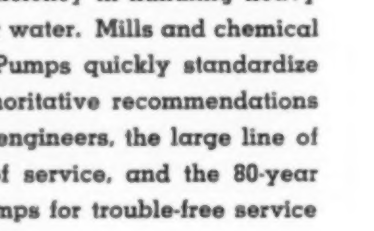

Double Suction Horizontally Split Pump for Clear Liquids

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Baldwinsville, N. Y.

MORRIS
ESTABLISHED 1864

EXPORT OFFICE:
50 Church St.,
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CENTRIFUGAL PUMPS

1942–43 season, there will probably be from 70,000 to 80,000 metric tons of castor oil or oil equivalent, available for export.

The 1942–43 castor bean crop estimate was 250,000 metric tons, which would make it the largest recorded in Brazil. Present indications are that the current crop will be comparable.

CARBIDE LIGHTING USED IN SWEDISH RURAL DISTRICTS

Carbide lamps are being used extensively in Sweden in isolated communities and rural districts which are not supplied with electricity and which formerly depended largely upon kerosene lamps and wax candles for lighting. The war has curtailed the importation of kerosene (the last significant shipment reached Sweden in 1940) and also the raw materials used in making candles.

To solve the lighting problem, approximately 400,000 carbide lamps are reported to have been manufactured in recent years. Ten factories are engaged in their production, and it is understood that practically all the carbide being used is obtained locally.

SWITZERLAND REGULATES SOAP PRODUCTION

The Swiss government's regulations concerning soap production provide that laundry soap must be composed of 60 percent fats and can be manufactured only in pieces weighing 100 grams. Scrubbing soap and hand soap, whether in tins or in cake form, cannot contain more than 30 percent insoluble matter. Rationed soaps and substitutes, the specifications continue, must bear the producer's name either on the package or the soap itself, and, in the case of the latter, the word "Substitute" must be printed on the wrapping or container. Certain standards have been set up, also, as to the ingerdients in substitute soaps.

VEGETABLE OIL PLANT UNDER CONSTRUCTION IN TORONTO

A $2,500,000 plant for the extraction and processing of soybean, linseed, and other vegetable oils is under construction in Toronto, Canada, according to the Canadian press. Immediate construction will include a $400,000 storage plant, with a capacity of 450,000 bu., and a screw-press process section. It is believed that production will begin by the middle of 1944.

The first operating section, the screw press process, will use approximately 3,000 bu. of soybeans daily, and the second section, a solvent-extraction process, approximately 4,000 bu.

BRAZIL PLANT TO PRODUCE DEHYDRATED CASTOR OIL

A monthly capacity of 60,000 lb. of dehydrated castor oil is the expected production of a plant to be erected in Brazil. The process, evolved in Brazil, requires heating the oil in an atmosphere of inert gas and in the presence of an acid catalyst. About 4.7 percent of the combined water is removed in this manner.

ACETANILIDE MANUFACTURE IN SWEDEN

MANUFACTURE of acetanilide was started by the Swedish chemical concern, Bofors, several years ago. Production has been increased from 30 to 40 tons annually to about five times that amount. This development is expected to be important in the manufacture of sulfanilamide preparations.

Acetanilide is not a wartime product in the usual sense. Its manufacture is the result of long-range planning intended to convert production facilities of the Bofors Co. to more diversified peacetime civilian requirements.

NEW ZEALAND MAY PRODUCE WAX FROM PEAT

A WAX, similar to montan wax, obtainable from peat in the Chatham Islands, New Zealand, has been investigated by the British Imperial Institute. Among the conclusions reached after a chemical examination were that it melts at 10 deg. C. lower than montan wax; that peat wax could be used as boot polishes; and that consideration should be given to extracting the asphaltic content by a petrol process.

Previous tests of New Zealand peat as a wax were undertaken by the Institute in 1926. Shortages of wax as a result of wartime conditions have resulted in renewed interest in this development.

FIVE RAYON PLANTS OPERATE IN STATE OF SAO PAULO

BRAZIL's rayon production is said to be centered in five plants in the State of Sao Paulo. In 1942, these mills had a combined output of 8,092,244 kg. of yarn, comprising 5,746,753 kg. of viscose yarn, 1,701,533 kg. of acetate, 32,375 kg. of cuprammonium and 611,800 kg. of staple fiber. The entire production reportedly is used within the country—25 percent for hosiery and knitted goods, and most of the remainder for dress goods, hat bands, and ribbons.

JAMAICA EXPANDS PLANS FOR MAKING ALCOHOL

CONSTRUCTION is expected to commence soon in Jamaica, British West Indies, on the proposed pilot plant to manufacture ethyl alcohol from rejected bananas. Erection of five other factories will follow, and it is anticipated that these plants will absorb about 3,000,000 stems of bananas annually, or whatever surplus remains above local and export requirements.

GLYCERINE FROM MOLASSES PROVES UNECONOMIC

THE manufacture of glycerine from molasses by a fermentation process has been abandoned by National Chemical Products, Ltd., of South Africa, states the company's annual report. Whereas glycerine of high quality, suitable for making dynamite, was produced, the process proved uneconomic, it is stated. The yield was lower than had been estimated and filtration offered a difficult technical problem.

Presenting the New

WILLSON MONO *Goggle*

The latest development in plastic eye-protection . . . combining safety, unobstructed vision and the highest degree of comfort.

NOTE THESE ADVANTAGES

1. Weighs only 1¼ oz., lightest goggle of its type
2. Crystal-clear plastic lens
3. Lens is non-shatterable
4. Lens is replaceable
5. Eye-nose shield an integral unit, leaving no open danger spots
6. High impact-resistance
7. Comfortable over glasses
8. Rolled edge makes smooth contact with face
9. Scientifically ventilated
10. Easily adjusted

GOGGLES • RESPIRATORS • GAS MASKS • HELMETS

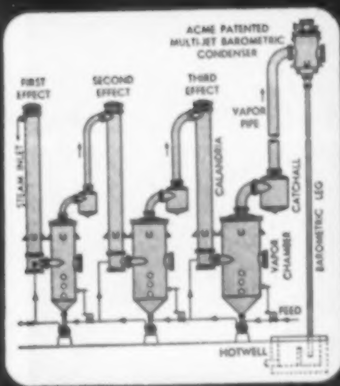
WILLSON (DOUBLE L)

PRODUCTS INCORPORATED

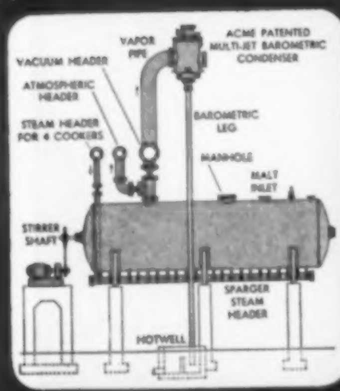
READING, PA., U.S.A. Established 1870

7 REASONS WHY . . .

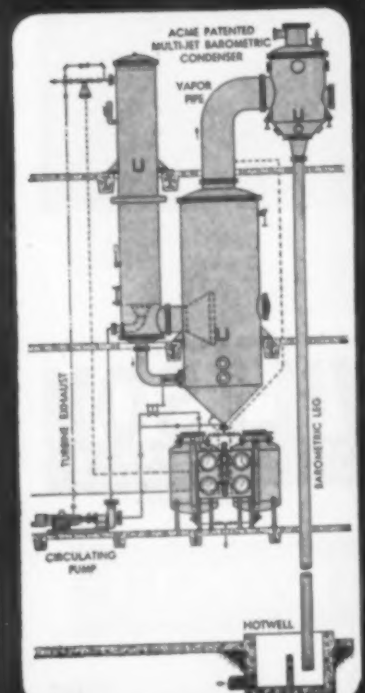
ACME *Patented* MULTI-JET BAROMETRIC CONDENSERS OPERATE WITH MAXIMUM ECONOMY!



CONDENSER FOR EVAPORATORS



VACUUM COOLING SYSTEM



CONDENSER FOR VACUUM PAN

Designed for vacuum processes where the condensate is not retained, the Acme Patented Multi-Jet Barometric Condenser combines the economies of both wet and dry operation. This patented unit offers the following exclusive features:

1. **COUNTER-CURRENT FLOW** that produces higher vacua (hitherto feasible only with dry operation).
2. **CONVERGING JETS** that expel the incondensible gases from the top of the condenser without the use of vacuum pump or ejector (the principal advantage of wet operation).
3. **A PATENTED SEAL** that prevents the escape of vapors until they reach the top of the condenser, thus making it possible to combine advantages (1) and (2) in one piece of equipment.
4. **POSITIVE CONTROL** of both involute and converging jets that attains maximum condensation at a minimum expenditure of water, even under fluctuating loads.
5. **LOW INITIAL COST** of equipment and installation.
6. **SIMPLE DESIGN** includes no moving parts, will not clog, and requires virtually no maintenance cost.
7. **CONVENIENT OPENINGS** for quick, easy inspection.

[Bulletin MJ-44 "Acme Patented Multi-Jet Barometric Condensers" sent upon request]

Where vacua over 27" Hg. are to be attained, we recommend the use of an Acme Counter-Current Barometric Condenser with suitable vacuum pump or ejector. The complete Acme line embraces every important type of condenser and ejector. Our engineers are prepared to study the requirements of any process and to make suitable recommendations for the most efficient operation.

ACME Processing Equipment

ACME COPPERSMITHING & MACHINE CO., ORELAND, PA.

FROM THE LOG OF EXPERIENCE

DAN GUTLEBEN, Engineer

A VISITING "SOOP" remarked that a few days ago he had discovered in his refinery a long 6 in. copper pipe that had been installed by his predecessor to test out a proposed process short-cut. The theory and the practice did not harmonize and so the valves were shut off and the pipe was forgotten. The pipe fitter was cautioned "Don't take it down, we might need it some day." The predecessor retired 30 years ago. Brainstorms come and go and sometimes they strike a bonanza. However, when some piece of apparatus becomes obsolete, it should be removed on the basis of "pro bono publico" which, being liberally translated, means that a little vacant space in a plant that is continually developing and changing is better than a space cluttered up with idle equipment. The house, like an unpruned tree, eventually becomes overwhelmed with dead branches and growth is hampered thereby.

IN FOOD AND SHIRTS the popular color is white. To attain whiteness in sugar, the syrup was formerly blown up with ox blood furnished from neighborhood slaughter houses. Emil Claus, Chief Engineer of the Edgewater Refinery (Ret.) entered the refining industry by way of the blow-up station at the Dick plant in New York in 1885. Blood was still used as a coagulant of impurities. The operators of the refinery had walked out without notice and left the blood and syrup to revert to basic elements, accompanied by the evolution of an impressive stench. The use of bone char and decolorizing carbons was a great improvement both technologically and psychologically. For sugar refining, bone char still possesses the preference over activated carbons. It has the ability not only to decolorize, but also to absorb certain salts and acrid aromas. This latter property is employed when medical practitioners prescribe charcoal tablets for a sour stomach. Bone char adds a heavy financial burden on the refinery. At present prices the char in process in an ordinary refinery may reach \$400,000 in cost and the equipment investment runs to about a million.

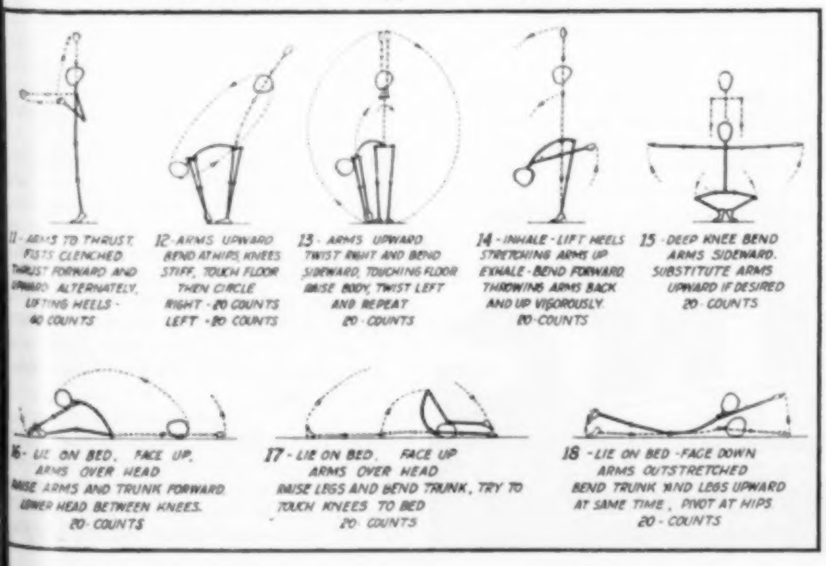
The mystery under which bone char performs its work has not yet been subjected to a clear-cut elucidation comprehensible to a run-of-mine engineer. For at least a half century the mechanical procedure has remained stationary. The only spectacular improvement was the thin stainless steel retort tubes contributed by Paul DeVries of Revere. Everybody is kicking about the awkwardness of the process. The chronicler sat in on a symposium wherein a group of chemists, with special emphasis, prefaced the discussion with the admission that they knew nothing about char. Then they read a verbose paper on the subject and followed with a two-hour debate! Q.E.D.

AT THE LABORATORY of the Drexel Evening School, Lab apprentice Carter was conducting a test that required the use of H_2SO_4. His eyes were intent upon the reaction while holding the test tube of acid in his hand. Under these circumstances he suddenly sensed that a mosquito was exploring about his neck, in search of a promising spot to set up operations. Carter reflexively obeyed the impulse to strike first and unwittingly dumped the test tube down his back. While he was at the hospital growing a new slab of skin on his back, he was bemoaning the destruction of his new silk shirt. The mending of this did not proceed by nature's munificence. It required the cash of the realm. On the other hand, his dad discharged the hospital bill.

WISDOM TEETH, crowded in the amen corner, get little exercise. They are the last to come and the first to go. Our electrical Wizard shared the common experience and when distress appeared, he had the upper ones removed. Later the lower ones suffered as a result of "innocuous desuetude." A youthful practitioner, appreciating the value of building up a backlog of custom, maintained the teeth by various treatments and an occasional filling. After enduring 10 years of expense, the Wizard at "long last" perceived the purposelessness of a pair of tongs with one jaw missing and so he got himself a new dentist and had the lower wisdom teeth removed.

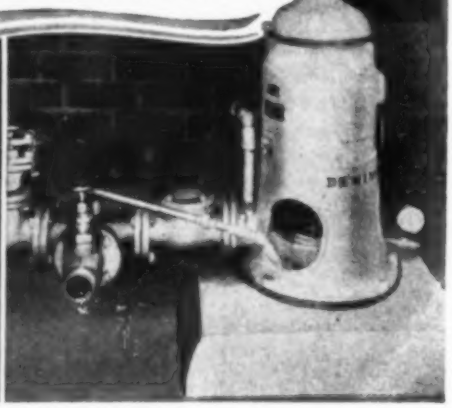
CHEMICAL MANUFACTURERS accompany their products with the privilege of the free advice of their staffs to guide the users. The customer accepts this as his perquisite and calls on the manufacturer's "Doc" whenever some problem perplexes him. The respect which the proffered assistance inspires can be enhanced by special technique. The customer propounds a problem puzzling to himself but it is elementary to Doc by reason of his 30 years or more of effort and experience. Does Doc spit out the answer spontaneously? He does not. His pearls of experience are not thus lightly to be cast away. He knits his brows professionally and hesitates; then he announces gravely that the problem will require thought and research. He reckons that he may be able to evolve a solution in a couple of weeks. Accordingly he marks his calendar and proceeds to forget all about the matter till the memo pops up a fortnight later. Then he calls up the customer and delivers himself extemporaneously of the answer. The customer values the answer, knowing the time and study that it called forth. And Doc's hokus-pokus gains the desired compensation in the way of good-will for his House.

Here is the balance of the setting-up routine followed by your chronicler. See *Chem. & Met.*, Feb. 1944, p. 201 for first ten exercises



256,608,000 GALLONS OF WATER PUMPED IN 27 MONTHS OF CONTINUOUS SERVICE

WEST COAST MANUFACTURER PRAISES SERVICE OF DEMING TURBINE PUMP



"You may be interested to know," wrote an official of a West Coast manufacturer, "that our Deming Water Lubricated Deep Well Turbine Pump has been operating continuously, 24 hours per day for the past 27 months without interruption, delivering about 220 gallons per minute to our plant.

"We have not spent one cent for repairs and the pump is running as smoothly and efficiently as the day it was installed. We are convinced that the Rubber Bearings with water lubrication are largely responsible for this outstanding performance and freedom from interruption of service."

Ask for Catalog No. 4700-8

This special catalog on Deming Deep Well Turbine Pumps is available from the Deming Distributor in your locality, or from The Deming Company, Salem, Ohio.

Deming Turbine Pumps are designed to deliver capacities from 15 to 3000 gallons per minute. Vertical hollow shaft motors are standard construction. Where required, other types of heads can be furnished such as: belted drive heads; gear increaser heads; steam turbine heads; flexible coupling heads; or combination type heads.

DEMING

THE COMPLETE LINE

PUMPS AND WATER SYSTEMS

The Deming Company · Salem, Ohio

BAG FILTERS constituted the common device for filtering sugar liquors up to about 1919. One of the 12-hour shifts was conducted under the profanity of Sergeant Jack McGahan. He was in command of an assortment of foreigners who had only a few years earlier escaped slavery in Europe. By comparison, their new job was an improvement. Jack's profanity was about equal in volume and differed only in that it contained fewer sneezes. The filters did an excellent job but the high operating costs were endured only because there was nothing better to be had. When Sweetland filters and eventually Vallez' replaced the old bags. Srgt. Jack joined the pipe fitters' gang. He resembled more or less any conventional style of pipe fitter except that, having been a top sergeant in the regular army, he was crankier than the rest. He became the trouble shooter and under this classification his task demanded jumping from hither to yon on emergency repairs. Every time he was called for a hurry-up job, he exploded. Never-the-less, in spite of all his cussing and obstreperations, he always dispatched the job. Occasionally, he celebrated too hilariously at the club and skipped work the next day to nurse the hangover. One day the master fitter decided to reduce his gang and his eyes fell upon "Useless", an inefficient attache who suffered from synthetic hookworm. However, when the fitter counted noses, he found that Useless was present and Jack was not. The ax therefore decended upon Jack. A few days later, by special request of the Chronicler, Jack was returned to the gang. His Irish humor was an asset to the House. He was the counterpart of the stubborn one in the parable of the two sons. The first one "answered and said, I will not: but afterward repented and went." It was agreed that he possessed qualities superior to those of the second who curried favor by answering "I go, sir: and went not."

TANKERS have been delivering molasses from the Tropics to our tank farms for the past twenty years. The No. 2 farm is located on a dark alley a quarter mile from tidewater, being connected by means of a 15 inch pipe under Delaware Ave. The tanks are 60 feet deep and the aggregate capacity of the four is 12,500,000 gallons. There has never been an overflow of these tanks even when the Cubans were pumping molasses into the tankers at one-eighth cent per gallon and sometimes letting gravity feed it to the sharks; that is, never except once and that was when the war price had gone to 18 cents. On that occasion 40,000 gallons oozed out of the vent in the roof and collected within the dyke. Most of it was later recovered. The superintendent made search for the cause. The tank man had the answer. When he awoke he announced that there was more room outside of the tank than inside. C'est la guerre.

EARLY MONDAY MORNING when the No. 5, 1000-K.W. generator went on the line, there was a suspicion of burning rubber in the air. Everybody in the Power Plant went about sniffing for the

origin. There were some short rubber wires on the generators but the switchboard instruments indicated no distress. Nevertheless, the boys feared the worst and so they sensed increased concentration of odor near the big generator. The Wizard stationed an electrician at the board prepared for quick action. The attaches became jittery. After 8 hours, when the next shift came on, the oiler pointed out a new rubber gasket that had been installed during his shift in the hot discharge pipe of the air compressor during the Sunday shut-down. The compresser was started at 7 A.M. and by 7:30 the pipe had reached vulcanizing temperature thus emitting the extremely distressing odor.

COPPERSMITH Joe Dvornvich fashioned a wondrous device of copper, and the photograph in the log shows Joe standing beside his handiwork. The device was a steam sparger which the boys dubbed "pretzel" when they installed it in the bottom of the "beer" still where it thereafter made possible the substitution of surplus exhaust steam for live steam from the boilers. ("Kernal Kirk" thought well enough of it to present it to the readers of Chem. & Met. January, 1938, p. 78). Joe was given a copy of the log. When the subsidized war plants began to exaggerate wages so as to draw out the men developed by the little plants, Joe took his copy of the log and picture to a large shipyard employment officer, and was hired instanter as a Class A artificer in copper. Our house thus lost Joe for the duration.

THE CHEMISTS ARE CONVERTING sow's ears into silk purces, wherein they exhibit superiority over the employment manager. Mentalities not technologically inclined have to be developed to function in mechanical arts. The girls taken from the household have to learn to leave their knitting and their favorite movie magazine at home. A "bo" rejected as military material replaces an experienced oiler who has gone forth. Among the new oiler's assignments is the re-filling of four gear cases on rotary pumps that deliver molasses and wort in the distillery. Nearby is the molasses weigh tank with a convenient sample cock and bucket at the bottom. Black strap molasses resembles 600-W oil in appearance and viscosity and so the oiler saw no reason for going to the store room 200 feet away when a substitute was right at hand. He therefore filled the four gear reducers with blackstrap. After four motor starters had burned out the electricians discovered the cause.

SIMILAR EXPERIENCES were lived through in the last war. A crew had to be broken in for the new beet sugar house at Hooper, Utah in 1919. For the engine room job a farmer was selected who claimed proficiency as hostler to a threshing machine engine. On the second day of plant operation, the main bearing burned out. The farmer was flabergasted. He had oiled every bearing but that one. He could not understand why the principle that he had learned as an average adjuster among the neighbors failed to apply.

EVERLASTING VALVES

The many important advantages of the Everlasting Valve . . . its drop-tight seal, its self-grinding action at each motion, its provisions against damage to disc and seat, and its "everlasting" wearing qualities . . . make these valves literally unequalled for many services on process lines, emergency shut-offs, equipment outlets, boiler blow-off, etc.

TYPICAL SERVICES WHERE EVERLASTING VALVES EXCEL . . .

Outlets of storage and measuring tanks

Throttles of hammers and hoists

Presses for plastics

Washers for laundries, cleaners and dyers.

Spray lines to rolls

Blow-offs of condensers, economizers, vulcanizers, purifiers, compressed air tanks

Suitable for acids, alkalies, caustics, cellulose, coal tar, emulsions, syrups, and other liquids; also gases and vapors

NOTE THESE FEATURES

Straight-through blow

Does not stick

Maintains initial tightness

Meets all State Boiler Laws and all requirements of A.S.M.E. Code

Proven by over 30 years of service

FULLY GUARANTEED

Write for Bulletin

EVERLASTING VALVE COMPANY

49 FISK STREET JERSEY CITY 5, N. J.

Everlasting Valves

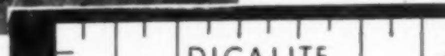
for everlasting protection

The Quality of DICALITE FILTERAIDS

A view from one of the Dicalite deposits, showing the exceptional purity of diatomaceous silica from which Dicalite filteraids are processed.

started here some 4,000,000 years ago

The quality of Dicalite filteraids began with the original diatom structure—"tailored" by Nature in form and purity most suitable for a filtration material. This natural advantage is enhanced by modern methods of processing, continuously controlled and improved by laboratory research. Because they give desired clarity at higher flowrates, Dicalite filteraids increase the total throughput of liquor per unit of time. Maximum output with thorough removal of impurities, insures high quality production at lower cost.



NINE GRADES of Dicalite filteraids, shown on the chart above, give desired clarity at a range of flowrates to insure maximum production at lower cost.

FILTERAIDS • FILLERS • INSULATION • ABSORBENTS • ADMIXTURES

DICALITE FOR VICTORY

THE DICALITE COMPANY

520 No. Michigan Ave., CHICAGO • 120 Wall St., NEW YORK • 756 So. Broadway, LOS ANGELES

JOBBERS AND OFFICES IN PRINCIPAL CITIES OF U.S.A. AND REPRESENTATIVES IN FOREIGN COUNTRIES

NAMES IN THE NEWS

G. E. Barton

F. A. Abbiati

Dwight R. Means

George Barton has retired after nearly 48 years of service with the Whitall-Tatum Co. and its successor, the Armstrong Cork Co. Mr. Barton is a charter member of the American Institute of Chemical Engineers and one of the oldest living members of the American Chemical Society.

A. H. Reu, acting plant manager of Hercules Powder Co.'s Brunswick, Ga., naval stores plant, has been named manager. He became acting plant manager of the plant in 1940 when **R. Rockwell,** plant manager, went to Chattanooga, Tenn., as Hercules plant manager of Volunteer Ordnance Works.

D. A. Hurst, formerly of the Research Division of the Barrett Division, Philadelphia, is now with Rohm & Haas Co. as a technical assistant. Mr. Hurst took his graduate work in chemistry at the George Washington University and his undergraduate work at Albion College, Albion, Mich.

Selwyn G. Blaylock, president and managing director of the Consolidated Mining and Smelting Co. of Canada, Ltd. of Trail, B. C., has been elected an honorary member of the American Institute of Mining and Metallurgical Engineers.

Roger C. Bascom has joined the technical service staff of Hycar Chemical Co. and will serve New England, eastern New York State and northern New Jersey. Mr. Bascom, who came to Hycar from Standard Products Co., where he was chief chemist, will make his headquarters and residence in Milford, Conn.

N. M. Barnett has been named manager of the Chicago branch office of Bailey Meter Co. to succeed **M. Greenberg** who resigned Feb. 1.

Charles P. Blinn, Jr., has been appointed vice president in charge of finance for the Publicker Commercial Alcohol Co. of Philadelphia.

F. A. Abbiati, who has held the position of assistant general manager of sales for the Plastics Division of Monsanto Chemical Co., Springfield, Mass. has been named director of sales for the division.

William E. Harrison has been appointed assistant fuel engineer for Lukens Steel Co. and subsidiaries, By-Products Steel Corp. and Lukenweld, Inc. A graduate of the University of Pennsylvania, Mr. Harrison joined Lukens in 1934.

Thomas H. Flaherty has been appointed head of the construction and engineering department for the five American-Marietta Co. plants. He will direct the paint company's building expansion program. Mr. Flaherty was formerly with the Austin and Koreschell Engineering Cos.

Henry M. Richardson, formerly with General Electric Co., has established himself as a consulting engineer on plastic products with headquarters at Pittsfield, Mass.

W. B. Rose, has been made division chief of the Charleston Research Division, Westvaco Chlorine Products Corp. **W. T. Nichols,** formerly Research Division Chief at Charleston has become technical assistant to the executive vice president. **A. G. Aitchison,** formerly assistant technical director, has been appointed technical director.

H. W. Catt has been appointed manager of the chemicals and pigments department of the purchasing division of The B. F. Goodrich Co. Mr. Catt, a graduate of the University of Illinois with a degree in chemical engineering joined B. F. Goodrich in 1929. He succeeds **Dr. V. E. Wellman** who becomes director of purchases in the company's newly created chemical division.

L. P. McAllister, who has been metallurgical engineer for Lukens Steel Co. since 1936, has been appointed assistant to the general superintendent with specific duties of quality control.

Dwight R. Means, who has been associated with the Columbia Chemical Division of the Pittsburgh Plate Glass Co. for 21 years, has been named assistant to the vice president. Prior to his new appointment he was technical director and had previously served as research director and assistant superintendent.

Lucien F. Craig has resigned from his position with the Supply and Transportation Division of Petroleum Administration for War.

Charles H. Briggs has joined the research staff of Truesdail Laboratories, Inc. Mr. Briggs holds a Bachelor of Science degree from Cornell University. For the past 35 years he has owned and directed the Howard Laboratory.

Edmund A. Georgi has been named manager of technical development in the Paper Makers Chemical Department of Hercules Powder Co. Mr. Georgi has been with Hercules since 1918 when he graduated from Cornell University.

Thomas A. Guerin, Jr., has won the 1944 Electrochemical Society Membership prize at Pratt Institute. The award is made annually to the most promising senior in electrochemistry.

Dene B. Hodges of the Shell Oil Co., has been appointed associate director of the Petroleum Administration for War's newly combined Supply and Transportation Division.

D. S. McAfee, vice president and director of the Dorr Co. has arranged to terminate his association with the company. He has for several years specialized in equipment and methods for the process industries. In addition to the North American Continent this work has included South America and parts of the Far East and Europe.

Karl E. Luger is now head of K. E. Luger Co., Houston, Tex., metallurgical

A *Tough Fire Hazard...*

A *Tougher* FIRE FIGHTER!

This is just another spot where DUGAS Fire Extinguishers are on the job. Ready for action!

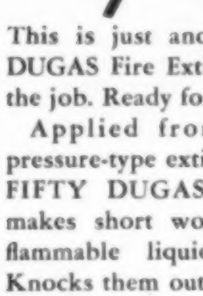
Applied from the DUGAS pressure-type extinguishers, PLUS-FIFTY DUGAS Dry Chemical makes short work of dangerous flammable liquid or gas fires. Knocks them out with tremendous speed!

Less hazardous for the operator, too, because PLUS-FIFTY DUGAS Dry Chemical does its work from safe distances. Non-toxic, non-corrosive, it hurts nothing except fire.

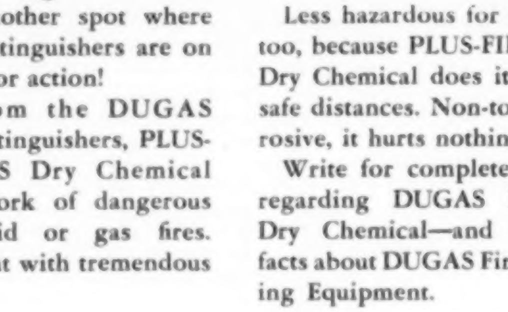
Write for complete information regarding DUGAS PLUS-FIFTY Dry Chemical—and for priority facts about DUGAS Fire Extinguishing Equipment.

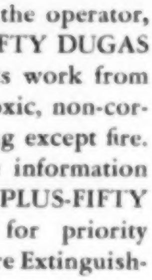
Approved by Underwriters' Laboratories and Factory Mutual Laboratories.

CHART showing characteristics of all types of approved hand fire extinguishers sent free on request.



MODEL 150 WHEELED EXTINGUISHER





MODEL 30-T HAND EXTINGUISHER

DCM—3-44

DUGAS ENGINEERING CORPORATION, MARINETTE, WISCONSIN

OWNED AND OPERATED BY ANSUL CHEMICAL COMPANY

engineers specializing in stainless steel applications.

Max A. Bradshaw recently returned to this country from England. Major Bradshaw, formerly with the Eastern Regional Research Laboratory in Philadelphia has been in the armed forces for some time.

Carl S. Miner, president, The Miner Laboratories, Chicago, has been elected as one of the councilors of the Purdue Research Foundation. Mr. Miner is representing the American Chemical Society.

OBITUARIES

Graham L. Montgomery, associate editor of *Food Industries*, died on Mar. 4 at his home on Long Island. Mr. Montgomery, a mechanical engineering graduate of Columbia University, joined the McGraw-Hill Publishing Co. in 1922 as an assistant editor of *Chem. & Met.* From 1927 until 1930 he was on the editorial staff of *Power* which he left to become managing editor of *Food Industries*. He was active in the affairs of the Institute of Food Technologists and the American Society of Mechanical Engineers.

Charles Copeland, formerly secretary and director of the E. I. du Pont de Nemours & Co., died Feb. 3 after a long illness. He was 76 years old.

James H. MacMahon, 83, pioneer in introducing the use of American-made bleaching powder and later liquid chlorine in paper pulp bleaching, died at his home in Buffalo, N. Y., on Feb. 7. He was intimately connected with the early development of chemical manufacturing in the United States, was widely known in the paper and other chemical-consuming industries and for nearly 40 years was connected with the Mathieson Alkali Works.

George L. Dumbauld, vice president treasurer of the Blaw-Knox Co., died suddenly Feb. 3 after an illness of several days. He was 61. Mr. Dumbauld had been identified with the growth and development of the Blaw-Knox Co. for 24 years in an official capacity.

Bevis Longstreth, president of the Thiokol Corp., of Trenton, N. J. died Mar. 1 following an operation. He would have been 51 years old this month.

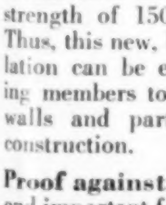
Fred W. Shibley, vice president of the Bankers Trust Co. for 18 years until he retired in 1939, died Mar. 1 at his home in New York after a brief illness. He was 80 years old. He was a director of a number of companies including St. Joseph Lead Co. and Manville Jenckes Corp.

Charles Randolph Borland, 74, for 26 years consulting chemist for the American Powder Co., Acton, Mass., until his retirement in 1930, died at Cambridge, Mass., on Feb. 16. He was born in London, England.

Jesse Jay Ricks, chairman of the board of Union Carbide and Carbon Corp., died at his home in Plandome, N. Y., on Feb. 20 after a brief illness. He was 64 years of

"Crusher Test" proves FOAMGLAS* is strong

Here's a moistureproof, fireproof insulating material with high crushing strength



Just how strong is Foamglas? This has been answered by tests made in Armstrong's Laboratories on this sensitive, accurate Baldwin-Southwark Universal Tester. When tested on all faces, Foamglas blocks have an average compressive strength of 150 pounds per sq. in. Thus, this new, low-temperature insulation can be erected without framing members to form self-sustaining walls and partitions in cold-room construction.

Proof against moisture is a second important feature of Armstrong's Foamglas. The material is composed of thousands of tiny cells—and each cell is completely isolated from adjoining cells by thin glass walls. Hence, neither moisture nor vapor can penetrate Foamglas—so it's just as efficient years later as the day it is erected.

Proof against fire. Since Foamglas is pure glass, it is absolutely fireproof. In many types of refrigerated construction—particularly in marine work—this is an extremely important requirement of the insulation.

Add them up—moistureproof, fireproof, and high structural strength, plus insulating efficiency and easy handling—and you have good reason for investigating this new, low-temperature insulation.

Write today for your free copy of the folder, "Armstrong's Foamglas," which gives complete physical data. Address Armstrong Cork Company, Building Materials Division, 4203 Concord St., Lancaster, Pennsylvania.

PHYSICAL PROPERTIES

Average crushing strength	150 lbs. per sq. in.
Modulus of rupture	90 lbs. per sq. in.
Modulus of elasticity	163,000 lbs. per sq. in.
Impact resistance	66 foot-pounds
Absorption (24 hr. immersion in water)	0.4% by volume, 2% by weight (all at surfaces)
Permeability	0
Capillarity	0
Volume change with moisture	0
Conductivity (K at 70° F.)	0.45 B.T.U. per hr. per sq. ft. per °F. per in.
Specific heat	.16-.19 per lb. per °F.
Coefficient of expansion	.0000046

* Trade-mark, Pittsburgh-Corning Corp.

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IT WAS dubbed a baby tower by the Knight organization because it was so small. Actually, it will do a lot of work for its size. It is designed to make 500 lbs. of 36% HCl per hour from 50% gas.

Pyroflex construction is not a pile of bricks or a lining. It is a completely designed functional unit. Each unit has the strength of steel and the corrosion resistance of ceramics.

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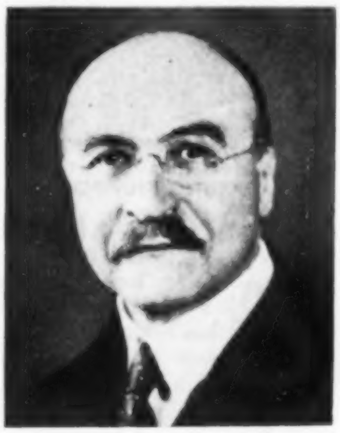
age. Mr. Ricks became chairman of the board of Union Carbide and Carbon Corp. in 1941. He had been president from October 1925 to May 1941. Nearly twenty years ago he instituted a liberal policy of research that has been in a large measure responsible for the growth of the numerous interests of the corporation which he headed.

Harry Fletcher Brown, a vice president and director of E. I. du Pont de Nemours & Co., died in Wilmington Feb. 28 after a long illness. He was 76 years of age. In 1900 he joined the International Smokeless Powder & Chemical Co., a subsidiary of the Marsden Co. When the latter company was acquired by Du Pont in 1904, Mr. Brown was given technical direction of smokeless powder manufacture at four Du Pont plants. In 1911 he became head of the Smokeless Powder Department, in 1914 he was elected a director and member of the Executive Committee, and in 1916 he became a vice president of the company.

Perley J. Buchanan, research chemist and director of chemical control of American Agricultural Chemical Co., died in Montclair, N. J. on Feb. 23 after 35 years service with this company.

James E. McDonald, 53, General Sales Manager of the Edward Valve & Mfg. Co. died Feb. 25 after an illness of several months.



L. H. Baekeland

Leo Hendrik Baekeland, one of the most widely-known American chemical engineers, died in Beacon, N. Y., Feb. 23 at the age of 80. Dr. Baekeland was born in Ghent, Belgium, Nov. 14, 1863, and came to this country in 1889. Here he engaged in chemical research and the first fruit of his efforts was Velox photographic paper. After effecting certain improvements in the equipment used in the production of caustic soda and chlorine, he turned his attention to synthetic resins. Bakelite, as is well known, was the result of these investigations.

During his lifetime Dr. Baekeland was the recipient of numerous honorary degrees, medals and awards given in recognition of his contributions to the industry and the world. He was a past president of the Electrochemical Society, the American Chemical Society and the American Institute of Chemical Engineers.

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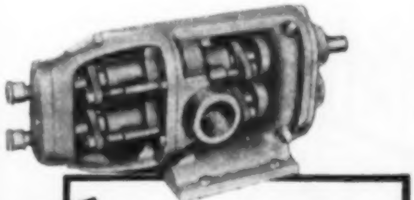

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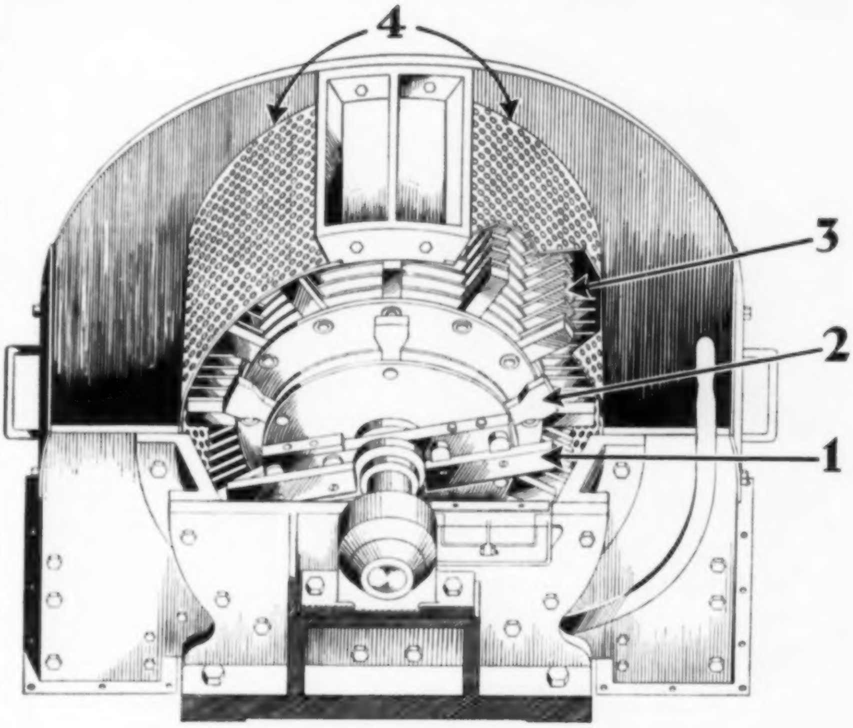

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Then the crushed material is fed around the entire periphery of the rotor to the final sizing blades (3) of the main grinding drum. The particle size is such that the greater part of the area can be devoted to screening. Because the dual screens are away from preliminary breaking and crushing they can be designed for true screening efficiency, as there are no large and heavy particles hammering the dual screens. This hammering in the usual mill distorts the screens and lowers screening efficiency still further.

The immediate value of the 70% screening area is immediately apparent to the grinding engineer—but there are many other factors in this principle of dual screens and dual drums, that are worthy of the study by the man interested in production control and low power cost.

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In many, many cases Layne Well Water Systems, due to their extra reserve of power and productivity, have saved untold thousands of dollars worth of property in cases of sudden emergency.

Layne Well Water Systems are specifically built to give their owners much more than normal daily operational service. They are built to give protection to property and lives.

If your city or manufacturing plant needs more water, please remember that Layne Well Water Systems produce great quantities at exceptionally low cost and at the same time provide an extra reserve of power and productivity that stand guard in cases of emergency.

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WELL WATER SYSTEMS

DEEP WELL PUMPS

BUILDERS OF WELL WATER SYSTEMS FOR INDUSTRIES AND MUNICIPALITIES

INDUSTRIAL NOTES

ELLIOTT CO., Jeannette, Pa., has selected R. W. Owens to be assistant to the president. Mr. Owens formerly was with Westinghouse as section engineer, manager of the industrial motor engineering department, general manager of industrial engineering, and manager of the motor division in charge of engineering, manufacturing and sales.

WISHNICK-TUMPEER, INC., New York, has changed its name to Witco Chemical Co. The change does not effect the corporate structure, management, or personnel.

LEBANON STEEL FOUNDRY, Lebanon, Pa., has opened a new office in the Commerce Bldg., Houston, Texas. Herschel J. Wood has been appointed southwestern representative and will be in charge of the new office.

ROHM & HAAS CO., Philadelphia, has inaugurated a pension plan for its employees which includes a monthly retirement income plus increased life insurance during active years. The entire cost of the plan will be underwritten by the company.

UNITED STATES RUBBER CO., New York, through investment in capital stock, has become associated with Compania Croydon del Pacifico, S. A., leading rubber manufacturer of Columbia, South America. The sales office which United States Rubber Export Co. has maintained at Bogota will be merged with the sales organization of Croydon.

FRITZCHE BROS., INC., New York, has appointed Stanley B. Schuster office manager of its Chicago branch. The Chicago office is under the general management of Joseph A. Gauer.

PAUL W. STEWART & ASSOCIATES, New York, has changed its name to Stewart, Brown & Associates. Dr. Lyndon O. Brown, professor of marketing at Northwestern University on leave, has been admitted as a partner.

WALTER KIDDE & CO., Belleville, N. J., has appointed C. E. Gischel director of product development in charge of postwar planning. He is succeeded as advertising manager by Gordon F. Ives who had been connected with the production department.

KEROTEST MFG. CO., Pittsburgh, has moved its New York office to the Lincoln Bldg., 60 East 42d St.

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, has placed William J. Massey in charge of lamp sales with headquarters at Bloomfield, N. J. In his new position, Mr. Massey will direct all lamp sales activities of the lamp division, the

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Set up a battery of Fletcher High Speed Centrifugals and you're bound to come out ahead in the battle against time.

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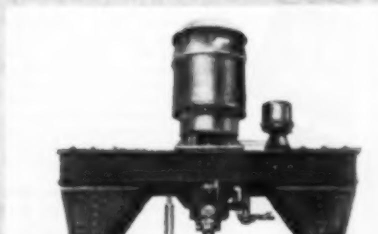


illuminating engineering, commercial engineering and advertising departments.

Lincoln Electric Co., Cleveland, is now represented in Detroit by B. J. Brugge as welding engineer. Mr. Brugge had represented the company in Los Angeles and Houston and prior to his removal to Detroit was located in Washington, D. C.

General Electric Co., Schenectady, N. Y., has named E. A. Green as general assistant to the manager of the motor division. He joined the company as a student engineer in 1924 and recently had been working on special assignments under the supervisor of apparatus production.

The Timken Roller Bearing Co., Canton, Ohio, has appointed Donald S. Klippert to the position of assistant general manager of sales of the steel and tube division. He has been succeeded as manager of the Cleveland office by Robert P. Donnell.

Devoe & Reynolds Co., New York, who recently announced the advancement of Arthur H. Mohrhusen to the newly created post of general merchandise manager, now report that Mr. Mohrhusen has been succeeded as manager of the brush division by George P. Gray who will be located in Princeton, Ind. Kenneth Wood succeeds Mr. Gray as field manager of the western division with headquarters at Chicago.

Machlett Laboratories, Inc., Norwalk, Conn., announces the appointment of Henry J. Hoffman as sales manager of the power tube division as well as administrative assistant to Miles Pennybacker, vice-president.

Joshua Hendy Iron Works, Ampere, N. J., has appointed Lyman D. Warner, sales manager and assistant vice-president of the Crocker-Wheeler division to succeed C. F. Poirier. Mr. Warner has been associated with the sales department since 1937.

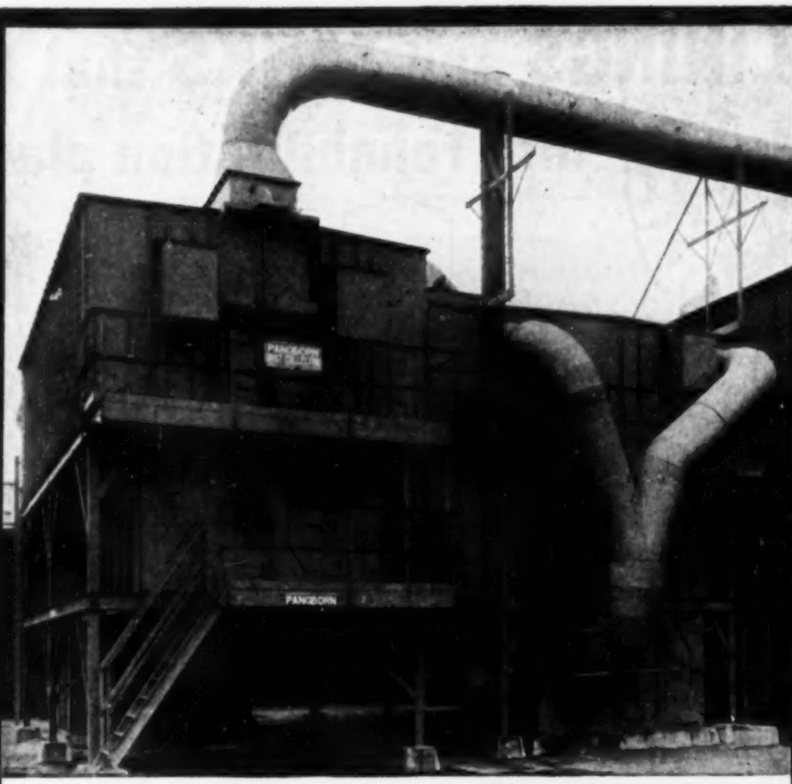
The Girdler Corp., Louisville, has added Boyd R. Hopkins to the sales department of the Thermex division. Mr. Hopkins will represent the company on the West Coast. He spend several years with Waugh Laboratories and with Magnaflux Corp. in their western offices.

Blaw-Knox Co., Pittsburgh, has advanced N. I. Mekeel, Jr., to the position of manager of the grating department to succeed Elmer E. Brodhead who has formed a business connection on the west coast.

The Davison Chemical Corp., Baltimore, has formed a process division with E. B. Dunkak as manager. The new division offers a complete design and equipment service for the process industries.

The C. M. Kemp Mfg. Co., Baltimore, is now represented in the New York territory by F. H. Yocum and A. H. Goode with headquarters at 420 Lexington Ave.

Allegheny Ludlum Steel Corp., Brackenridge, Pa., has named P. E. Floyd



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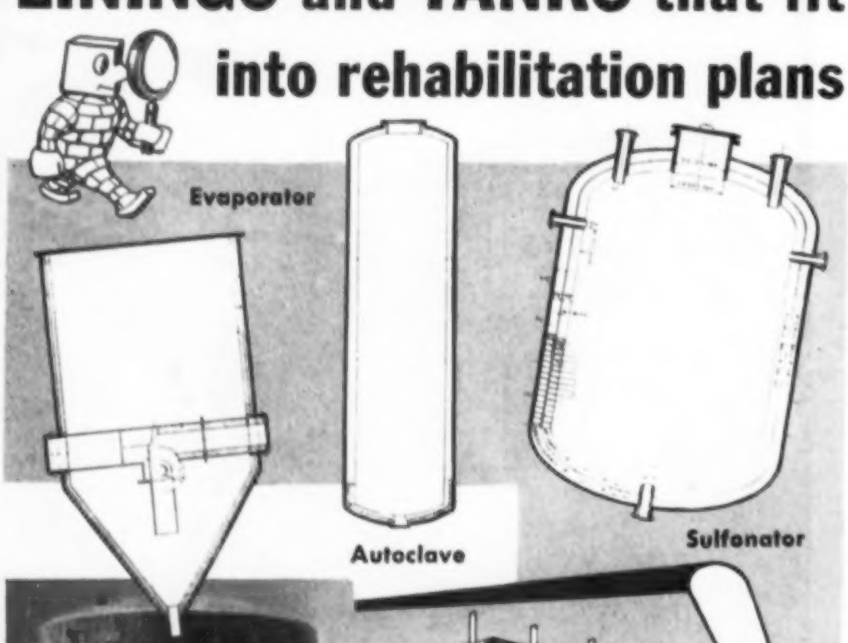

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We can furnish linings of brick, tile, porcelain and carbon materials for both acid and alkali conditions. For certain specific requirements, our resin membranes, resistant coatings and rubber films, in combination with brickwork, are most effective.

Reline the "Stebbins Way" and take advantage of our complete service: Every job is covered by a lump sum contract. We supply all labor and material and turn the completed lining over to you ready for use.

SEMCO

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assistant general manager of sales. Mr. Floyd recently returned to the company from Washington where he served as chief of the steel division of WPB. Before going to Washington, he was manager of the corporation's office in Chicago.

American Chain & Cable Co., Inc., Bridgeport, Conn., has appointed Alton Parker Hall assistant manager of sales. He assumed his new post on March 1 with headquarters at 230 Park Ave., New York. Mr. Hall had been associated with Bethlehem Steel Co. since 1922.

Allis Chalmers, Milwaukee, has set up a new basic industries department which will correlate the activities of the crushing, cement and mining machinery division, flour milling and oil extraction division, and saw and pulp mill division. Walter Maxson will manage the department. The company also has established a separate Texrope division with T. C. Knudsen in charge.

The Pennsylvania Salt Mfg. Co., Philadelphia, has moved its New York office to 40 West 40th St. This office is headquarters for two of the company's sales districts, one headed by F. G. Rodenburgh and the other by C. A. McCloskey.

Manheim Mfg. Co., Manheim, Pa., has advanced Vincent K. Alexander to the position of sales manager. For some months, Mr. Alexander had served as acting sales manager and prior to that was in charge of the Chicago office of the company.

Wyandotte Chemicals Corp., Wyandotte, Mich., has selected C. T. Robinson to manage its Cincinnati office to replace C. D. Morris who left the company to enter the merchant marine service. Mr. Robinson joined the company in 1927 and for several years was central regional supervisor for the J. B. Ford division.

Kaydon Engineering Corp., Muskegon, Mich., has appointed B. M. Staley factory manager. For the last 12 years Mr. Staley had been with the rotary pump division of National Transit Pump & Machinery Co. at Oil City, serving successively as chief engineer, superintendent and general manager.

Hooker Electrochemical Co., Niagara Falls, has assigned Thomas H. Trimble as its sales representative in the eastern Middle Atlantic territory with headquarters at 60 East 42d St., New York. Ralph E. Davis, Jr., has been appointed sales representative in upper New York and western Pennsylvania with headquarters at Niagara Falls. He will continue his special service for the leather industry.

SKF Industries, Inc., Philadelphia, has placed Walter C. Ahlers in charge of its office in Detroit to succeed Robert H. Hirsch, resigned.

Hercules Powder Co., Wilmington, has appointed George A. Paine district manager of the synthetics department for the New York territory and Paul L. Lefebvre as district manager for Chicago.

Disposal of Government Inventories

How to dispose of government surpluses when the ar ends need not be an insuperable problem – if we ce it promptly and intelligently. But if we do not, eacetime markets may be disrupted, government funds asted, production discouraged, and reconversion of the hole economy to peace seriously hampered.

What we need most in order to attack the problem estimates of how much surplus there will be, in what pes of goods, and where.

At the war's end, government inventory of war goods likely to total around 60 billion dollars. Most of this ill consist of aircraft, ships, and other ordnance. Only me 15 billion dollars or less will be in food, clothing, ucks, tools, chemicals, medical supplies, transportation, ngineering and communication equipment, and other oods for which there is a civilian market.

In addition, war contractors will have about 10 billion llars of inventories, the bulk in specialized raw mateals, goods in process, and finished products. Only about ne-fifth of the total, or some 2 billion dollars, will be arketable or usable for civilian purposes. While the overnment takes over the usable inventory, the exar-contractors will have to build up their stocks for eacetime production, so that on balance, they will ot be disposing of usable inventories in large volume.

Not even all of the usable war-end inventory will be urplus" for sale to civilians in competition with new oduction. Some of it will be needed by the sizable eacetime Army and Navy we are likely to maintain, d such additional items as can be stored without seris deterioration or obsolescence will be held against ssible future war emergencies. Some of it will be sposed of abroad. And up to half of it will be abroad d may be sold there or used for relief.

After allowing for these factors, the war supplies to e disposed of in our own markets probably will be less an 10 billion dollars (cost basis). While the total not overwhelming – the equivalent of two months' tail sales – in certain lines the surplus will be several ars', instead of a few months', normal supply. In rticular, the volume of scrap metals available from otherwise unusable munitions will present a problem.

A great deal can be done now to reduce the size of the postwar surpluses by achieving a better balance between military needs and supplies and avoiding excessive inventories of particular raw materials or finished goods. This work needs to be pressed, not only to simplify our transition to peace but also to prevent wasting productive energies during the war. Furthermore, when the war ends on one front, inventories of war materiel should be worked down to the reduced scale of remaining military activity.

We cannot develop programs of action until we know approximately how much of each type of item is to be sold, and where and when it will be available. Wide margins of error are inevitable as long as large-scale procurement and large-scale consumption are still taking place; yet such information is essential and must be developed. Indeed, improved inventory records and estimates are badly needed for the conduct of the war as well as for managing the surpluses after hostilities cease.

In decisions on the disposal of war-goods inventories, the public interest must be the prime consideration. Proposals that none of these goods should be sold domestically because of competition with new production obviously are untenable. Everything that is not needed by the Armed Services or for other special purposes should be disposed of ultimately. The real problem is not whether surpluses should be sold, but rather to whom, at what price, and at what time the sale should be effected.

In the distribution of such large quantities of goods, we believe that established trade channels should be used wherever possible. Otherwise, we shall witness widespread speculation in war goods and the mushroom growth of inefficient and disruptive fly-by-night distributors. This will benefit only a few speculators and will discourage legitimate producers and distributors from making their normal commitments.

All war contractors should have the privilege of retaining those inventories for which they are willing to pay actual cost or a fair price negotiated with the gov-

ernment procurement agency. The balance of the inventories in the hands of war producers should be assembled by the government and sold in an organized manner. It is of great importance that the plants be cleared of these inventories at once so that the process of conversion to peacetime operation can proceed without further delay. To accomplish this, preparations must be made before the end of the war for speedy determination of the inventories to be moved and for a huge volume of storage space to accommodate them.

The price which can be realized and the timing of sale are closely related. Certainly the best prices will not be secured if the government attempts to dispose of large supplies of material and products suddenly without regard to market conditions. Most businessmen rightly favor an early transfer of surplus inventories from government to private ownership. But, they also realize that if all the surpluses are dumped indiscriminately as they become available, many markets will be badly depressed, and the resulting low prices will bring lower production. If this depression effect becomes general, as it easily can, it will be costly to the nation in terms of jobs, income, and goods.

In industries in which production is inadequate to meet postwar demands, an immediate sale of government inventories can prevent inflated prices and preserve balanced market conditions. In cases in which the surpluses are large in relation to annual production, the disposition can be scheduled over a period of years. Generally, however, it will be best to clear the surpluses as quickly as orderly sale can be accomplished rather than to leave them as a continuing threat overhanging the market. Most industries can, and should, take the disposal process in their stride without special dispensations from the government. In this connection, it should be noted that the tax provisions for carry-back of losses and excess profit credits after the war greatly increase the possibilities for speedy disposal of surpluses without serious injury to producers.

There will be some industries, however, in which the postwar surplus is so large that it would practically saturate the market for years to come. The problem of these industries is further complicated by their wartime expansion of capacity many fold in excess of peacetime requirements. These lines of production are, moreover, crucial for our national defense. Aircraft and shipbuilding are cases in point. Each of these situations calls for careful study and discussion by all concerned to devise means to keep alive the necessary production organizations, the research effort, and the spirit of enterprise. Insofar as possible, the individual manufacturers should work out their own salvation in the conversion to peacetime markets. They can do this by taking on new lines, by increasing their production efficiency, and by developing technical improvements which make the existing inventories obsolete. But they still will need some kind of government protection or assistance while the huge surpluses are being worked off. It is most important, however, that such protection or subsidy be limited to a period of three to five years. It must not become permanent unless it is really essential for our national security.

The disposal of surplus inventories is part of the whole process of demobilization of the war effort and conversion to peace. If this process is to be accomplished with minimum dislocation and injury to our economy, it will have to be directed by a central agency which has developed adequate information service and is in position to coordinate the policies of the Armed Services and the other interested executive branches of the government. This agency should draw freely on the knowledge of businessmen in the specialized problems of marketing surpluses in each industry. It should formulate definite programs of inventory disposal for all industries in which the problem is acute; and it should make these programs public as soon as possible, so that business can plan for the future with confidence. In large measure, the success with which we make the economic transition to peace will depend on the quality of government administration in the process of industrial demobilization. We shall need better organization for the transition to peace than we had in mobilization for war if we are to avoid needless unemployment, loss of production, and frustration of business enterprise.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

CONVENTION PAPER ABSTRACTS

PAPER COLORING

Naphthanils belong in the class of colors known as azoic colors. This means forming an azo dyestuff directly on the fiber. The naphthanil process may be used to color paper either in the beater or by surface application. A water soluble naphthanil "prepare" is formed by treating the naphthanil with caustic soda. These prepares have a certain degree of affinity for cellulose and will exhaust on the fiber. The addition of a diazotized amine causes a rapid coupling reaction to take place forming a bright color directly on the fiber. Almost a complete range of shades is possible by using naphthanils, but the orange, red, and yellow shades form the bright shades for which these dyes are famous. These colors are suited for dyeing twisted papers used in auto seat covers, paper rugs and woven paper sacks.

Sulphur colors may be beater applied to paper from a solution of the color reduced with sodium sulphide. Formerly the liberation of hydrogen sulphide vapors when the beater was neutralized limited the use of these colors. Today the use of certain heavy metal salts such as zinc chloride and copper sulphate eliminates the odor and neutralizes the excess alkalinity in one operation. Sulphur colors are ideal colors for granite fibers and for dyeing all types of heavy black and brown shades.

Vat colors have the best all around fastness of any group of textile colors. They are usually bright, with outstanding light fastness and are water insoluble. In general they are fast to chlorine, acids, and alkalies. They may be beater applied to paper from an alkaline hydrosulphite reduced solution of the color. This "leuco" exhausts on the cellulose fiber and may be air oxidized to give bright shades of every desired hue.

H. A. Lips before 29th TAPPI Annual Meeting, New York, N. Y., Feb. 14, 1944.

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Distillation implies more than setting up a flask, condenser, and receiver. Even in the laboratory efficient fractionating columns are employed for analysis of mixtures and purification of compounds; and to the chemical engineer distillation may imply a series of heat exchangers and of columns, maybe as large as 20 ft. in diameter and 200 ft. high, as employed in the precise separation of hydrocarbon gases.

The requirements of a problem involving the separation of a binary mixture by distillation involve two prime considerations: the number of theoretical stages of equilibrium contact and the reflux ratio. These can be determined graphically by means of the McCabe-Thiele diagram, on which is plotted the equilibrium composition of the vapor, y^* against the liquid composition, x, and the relation between the composition of the liquid flowing down the column, x_{n-1}, and the composition of the vapor rising to the same point, y_n,

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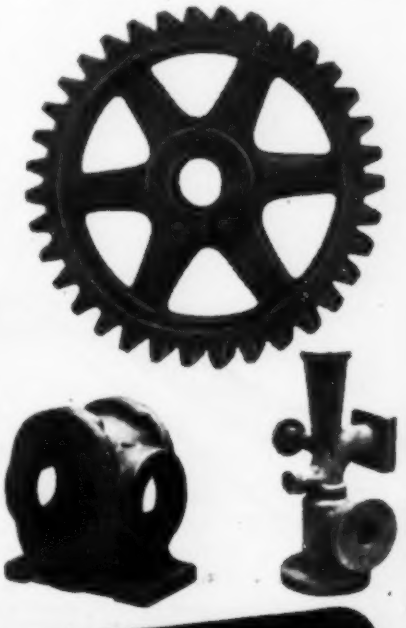

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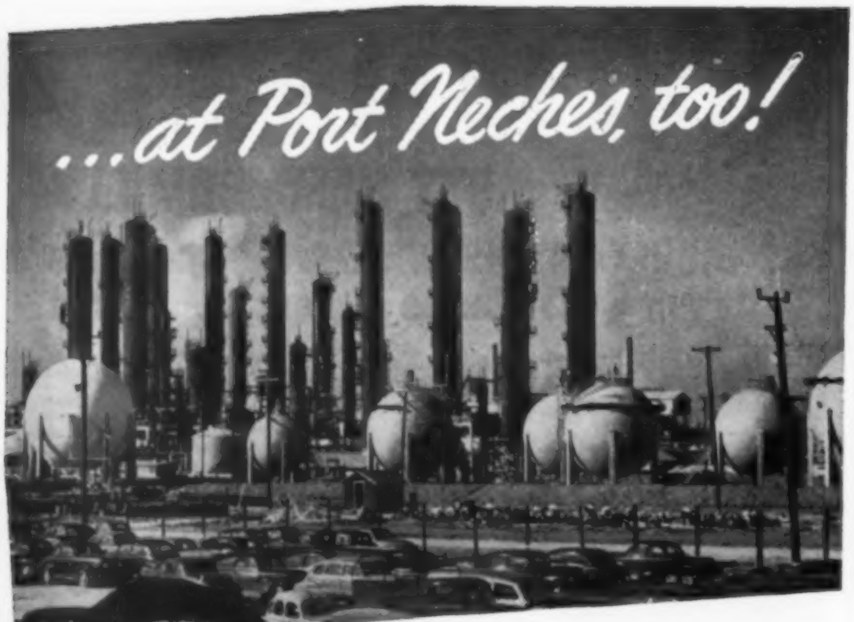

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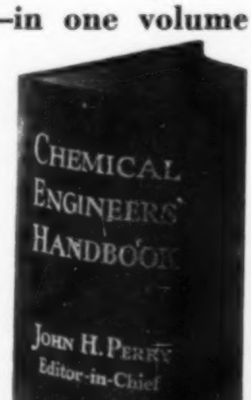

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bombers raiding Berlin from bases in England use 100,000 bbl. of 100-octane aviation fuel. This is equivalent to six months' production in 1937.

It isn't only in gasoline requirements that petroleum engineers have been called on to meet war's need. They found a way to make toluol for TNT. No longer is there a threat of a shortage so far as this war is concerned.

And rubber? That might have been like an Achilles heel for the United Nations. The chemical and oil technologists met this gravest of challenges. When some future word wizard tells the story of industry in this war, the recital of synthetic rubber manufacture will be among his most fascinating tales.

What the oil industry has been doing in this war, every other industry has done in its own field. The accomplishment of American producers has been so great that it will take years for us to realize its full import. We need perspective to really grasp what has been done. But we require no lapse of time to know that this wonderful achievement came not only from nature's bounty in material wealth. Rather, it came from the minds of men, particularly America's engineers.

Our country will emerge from this war as the strongest national entity that ever has existed. With such power goes great responsibility. If our engineers help to exercise that responsibility in matters of international decision, perhaps they can determine that the work of their minds and hands will be peacefully directed to the good of mankind.

Of all classes of men, classifying them by the nature of the work they do, none is more important than the engineer. Few are as important. It is the engineer who eases the physical load of life, improving contact, making living brighter, more healthful, more enjoyable, more useful. There is an immeasurable amount of all this which needs doing.

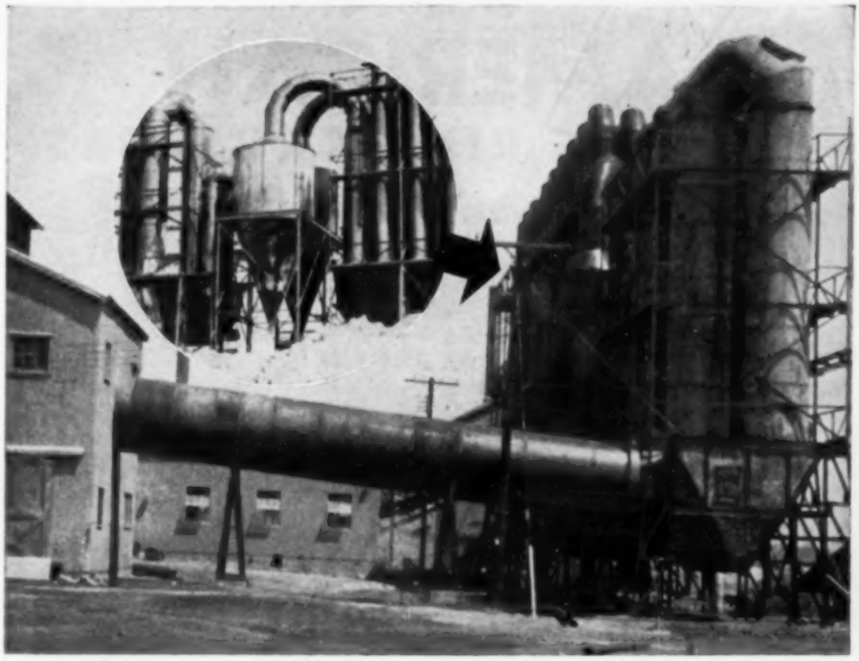
E. R. Smoley, the Lummus Co., at Class Day Exercises, the Massachusetts Institute of Technology, Feb. 26, 1944.

LUMINESCENT PIGMENTS

Luminescence, the phenomenon of absorption of ultraviolet light and re-emission of this energy as visible light is finding practical applications today in the paper and printing arts. Two types of luminescent pigments are defined as fluorescent pigments which glow while excited, and phosphorescent pigments which have a useful afterglow.

Light sources providing satisfactory excitation of luminescent pigments in the long ultraviolet spectral range include daylight, incandescent filament lamps, argon glow lamps, mercury vapor lamps, and fluorescent lamps.

Fluorescent pigments are classified as either organic or inorganic. Organic pigments are usually dyes, lakes made from such dyes and metallic salts of dyes, and dye intermediates. They possess high fluorescent brightness and brilliant color but are subject to fading and loss of fluorescence on exposure to sunlight. Inorganic pigments most used are zinc sulphide and zinc and cadmium sulphide. These are crystalline pigments having white or yellow



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For the past two years Norblo fume collecting equipment has gone mainly into the smelting field. Norblo systems are incorporated in the several outstanding Eagle-Picher and Bunker Hill slag fuming installations. In the brass foundry of the largest cartridge factory in America, Norblo is saving zinc at the rate of 3,000 tons a year. In a new plant, The Samuel Greenfield Co., Buffalo, N. Y., for reclaiming copper from brass scrap Norblo has made it possible to salvage most of the zinc formerly lost.

In all of these and many other installations the high efficiency of Norblo Automatic Bag Type Fume Collectors combined with Norblo Centrifugals solved the engineering and metallurgical conditions required and made possible technological advances which will continue after the war and be applicable in many other fields. Whatever your fume or dust collection problems may be Norblo engineers welcome your inquiries.

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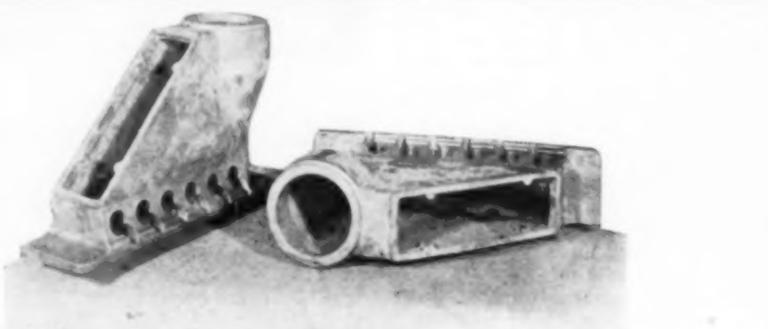

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arise as a result of new developments. Experimental work has indicated that nitrous oxide has bactericidal and bacteriostatic actions under certain conditions and its use for the preservation of foods has been suggested because of this action combined with its lack of toxic effects.

William Strobach, The S. S. White Dental Mfg. Co., Staten Island, N. Y., before the 31st annual meeting of the Compressed Gas Manufacturers' Association, New York, N. Y., Jan. 25, 1944.

PORT NECHES SYNTHETIC RUBBER

Six thousand men have been sweating at Port Neches in the face of all kinds of obstacles, and a few brickbats, to create and put "on stream" the first half of the largest single petroleum plant in the synthetic rubber program.

Prior to the war, during the war within the limits of the controls which we have had to impose for the greater good, and after the war the five companies—Atlantic, Gulf, Magnolia, Pure and Texas—have been, are, and will be competitors in the oil business. They first met to aid the synthetic rubber program at the invitation of government. Under special blessing of government they have acted cooperatively to build an efficient machine for butadiene production.

They organized a non-profit corporation to operate a joint enterprise for government and staffed the program with the best technologists who surveyed, according to their best judgment, all the information available. Such data as were in the possession of other competitors were turned over by them promptly and fully. Technical committees selected processes and process steps which were in no case those sponsored by any particular company.

A small part of the normal butylene which is produced in the five refineries in the Neches area is the raw material from which butadiene is made in this government-owned industry-operated plant. The price which each is to be paid for this raw material was separately negotiated with Rubber Reserve Co. The cost methods used in determining each of these separate prices were the same as those developed by the Petroleum Administration in its 100 octane program. Rubber Reserve used the Petroleum Administration as a technical advisor for this purpose.

It should be noted for the record that even with the vast new equipment investments and operating costs necessarily incurred, the contract prices for the butylene which is supplied to the Neches plant are only a few pennies more per gallon than the current wholesale price of premium motor gasoline at refineries in this area. Incidentally, the total volume to be supplied—about 4,500 barrels per day—is less than 1 percent of the total output of refined petroleum products of the five participating petroleum refiners.

It is true that this volume is a considerable though minor portion of the total butylene and butylene equivalents (iso butylene and amylenes) to be used by the five Neches refiners in producing 100 octane gasoline and butadiene. But in addition it must be borne in mind by those who have feared a shortage of butylene for the rubber program that for every refinery

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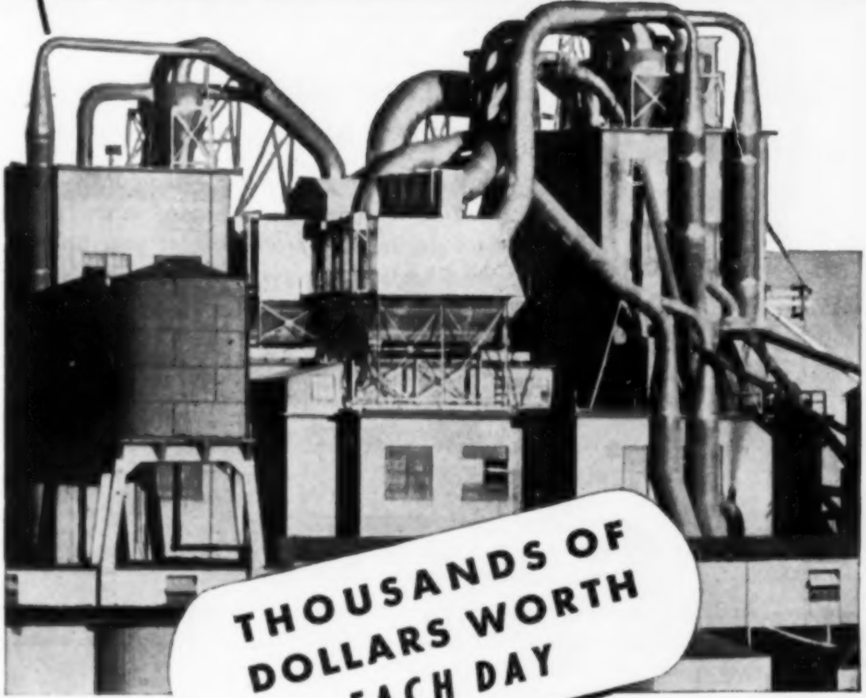

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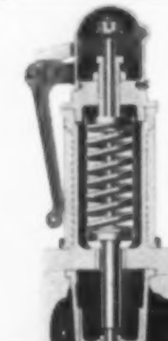

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making 100 octane gasoline in the United States which is called upon to make any butylene contribution for butadiene production, there will be five other 100 octane producers whose butylenes are not needed at all in the rubber program as well as a host of other refineries which are supplying butylenes, either as such or as "codimer", which flow into the 100 octane program.

Bruce E. Brown, Assistant Deputy Administrator, Petroleum Administrator for War, at dedication of Neches Butane Products Co. plant, Port Neches, Texas, Feb. 23, 1944.

RESEARCH OF TALL OIL AND SULPHATE TURPENTINE

During the present emergency, tall oil and sulphate turpentine enjoy a market in excess of normal times. Tall oil is chiefly employed to compensate more expensive fatty acids primarily in the manufacture of various kinds of soaps and as a drying oil for cheap paints. It is noted that this commercial demand follows a similar pattern as in the Scandinavian countries during the last war.

Tall oil resin acids are more uniform in composition than those of rosin, and hence, produce high yields of dehydroabietic acid on disproportionation of hydrogen in the highly unstable abietic acid molecule. Tall oil is not only an excellent raw material for making of this stable resin acid, but it may also serve as a chemical raw material for making of products now manufactured from coal tar. Crude sulphate turpentine renders itself easily to processes for producing of high grade pine oil and other derivatives of terpenes.

It may be to the advantage of the sulphate pulp industry to develop their byproducts along cooperative lines in the commercial utilization of tall oil and crude sulphate turpentine as chemical raw materials. The establishment of central plants would apparently best permit the industry to capitalize on the potentialities of their byproducts.

T. K. Hasselstrom, G. & A. Laboratories, before 29th TAPPI Annual Meeting, New York, N. Y., Feb. 15, 1944.

SYNTHETIC RESINS IN PAPER

The part played by synthetic resins in paper manufacturing, while now significant, gives every indication of assuming greater importance in the post war period. However such a development depends upon a proper evaluation of resin film properties when incorporated into paper making as against its behavior in other fields.

They must, first, be water soluble or water dispersible; second, lend themselves to specific application in the usual paper making operation; third, be odorless, colorless and, for many purposes, tasteless and non-toxic and, finally, they must not excessively increase the cost of the finished paper. Other factors are probability of excessive machine time, broke recovery, variations in wet strength and grease-proofness, corrosion of equipment and aging characteristics of the finished product.

Certain resin types have had limited or no application in the paper manufacturing process. Among these are the phenolic resins which tend to yellow upon aging, require long curing periods and are not satisfactorily soluble; the alkyd resins

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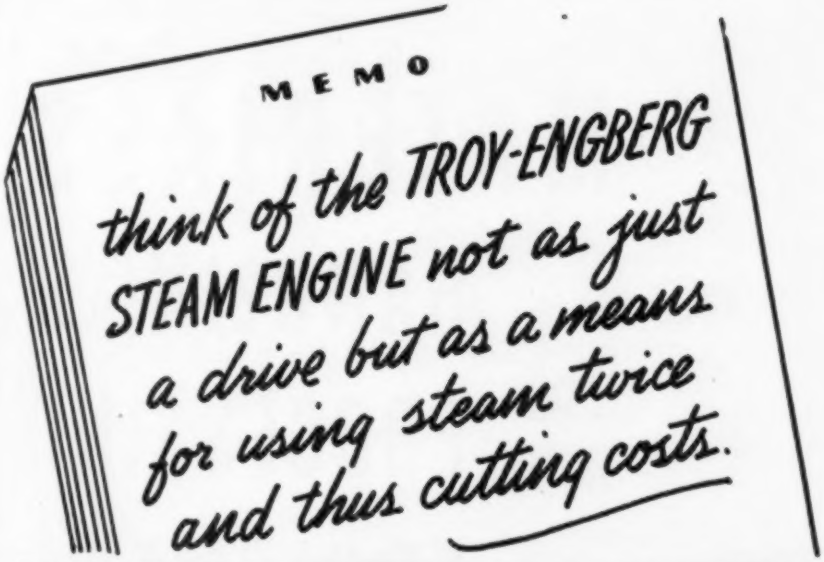

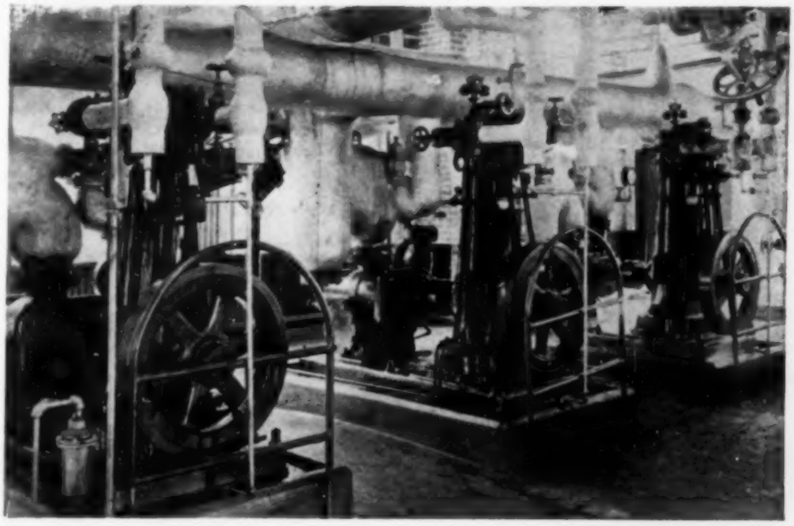

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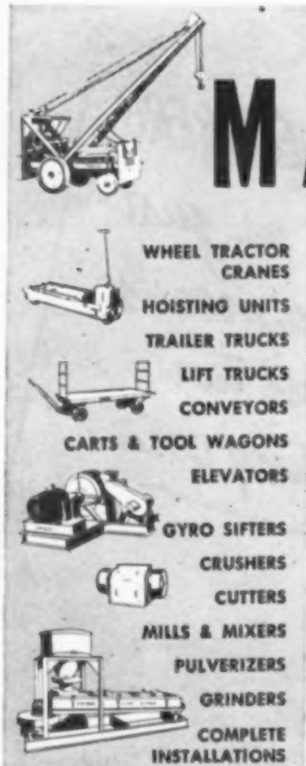

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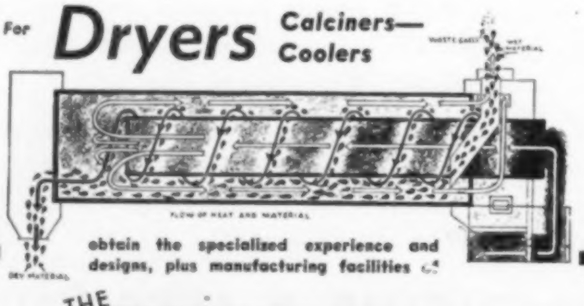

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which, with certain exceptions, do not possess satisfactory solubility and permanence; and the vinyl and acrylic resins, most of which have not been adequately investigated. Those resins which have demonstrated varying degrees of usefulness in paper making may be classified in the urea and melamine formaldehyde group.

It was not until fairly recently that the resins were used in commercial quantities as tub sizes. Previous attempts failed largely because the urea-formaldehyde resins were not sufficiently substantive to the fiber and did not precipitate well enough in the beater to have satisfactory retention. Minor improvements followed with the result that appreciable amounts were used for various applications.

The use of melamine-formaldehyde resins in paper making resulted in the retention of wet tensile and wet burst of an order of 50–60 percent of dry tensile, and a large increase in wet rub as well as a 15 percent increase in dry bursting and dry tensile. A urea-formaldehyde resin known as Uformite 466 permits the use of a resin of this type as a beater size. This material meets the three principal requirements: it is water soluble, combines chemically or is physically absorbed by the pulp, and converts to an insoluble form in a limited time on the machine. In actual practice, wet strength of the finished product is proportional to resin concentration and at the higher resin concentrations, the increment per added unit of resin is less. Most cases do not require a resin concentration higher than 3 percent based on the pulp.

Experience indicates the desirability of adding this type of resin as early in the paper making process as possible, preferably in the beater rather than in the headbox or fan pump. The use of other ingredients normally used in paper making, such as rosin and starch, have no appreciable effect on resin application. At the present time, Uformite 466 is finding commercial application in the production of toweling, blue print, tag stocks, map and chart papers, bag and wrapping papers, glassine and greaseproof papers, tissue papers, manual and book papers and other miscellaneous types.

Louis Klein, The Resinous Products and Chemical Co., before Lake State Section, TAPPI, Feb. 11, 1944.

MELAMINE RESINS

Chemical industry introduces new products, not always at the time they are initially developed, but more frequently as the need for them arises. The new plastic products that have been introduced during the last ten or fifteen years, have made major contributions to the better performance and serviceability of innumerable products. The raw materials and the resins produced from them were developed in the chemical laboratory, with little thought as to what might be their ultimate commercial application.

The rapid growth in the use of the resins produced from melamine is an outstanding example of how the science of chemistry and the chemical industry have contributed to the spectacular progress of the plastics industry.

Some years ago it was found that melamine reacts with formaldehyde to pro-

duce a soluble and fusible resin. This resin is colorless and water clear when produced from pure materials. It is hygroscopic and miscible with water and water-alcohol mixtures. When subjected to heat, or under the influence of certain chemicals, it becomes insoluble, infusible, and, as compared to its unconverted form, relatively tough. This change can occur over a wide range of acidity and basicity, in contrast to other thermosetting resins. The unconverted resin is capable of reacting with alcohols to form resins soluble in a wide variety of organic solvents. Melamine resin can be used in combination with either mineral or cellulosic fillers for molding compositions and laminated articles.

It was found that melamine resins will cure in contact with the heat resistant inorganic fillers such as asbestos, glass and silica. Asbestos filled molding compounds were consequently developed, and have extensively replaced hard rubber and other plastics in aircraft ignition systems.

In many of these applications, large parts weighing several pounds and containing numerous metal inserts are involved. Were it not for the advent of transfer molding, it would have been feasible to produce such intricate parts.

Melamine laminated products which possess these added advantages of arc and heat resistance are now commercially available for use in electric insulation. It is to be noted that even the fabric base material is self extinguishing. The glass cloth and asbestos base products are, of course, more highly heat and fire resistant.

In addition to these war essential applications of melamine, which are based on electrical insulating properties, there are many other applications contributing to the war effort which are based on other properties imparted by melamine resins.

Prior to the war, melamine resins were used quite extensively in paper laminates to impart hardness, scratch-resistance, color stability, heatproofness, and protection against the action of cleaning agents.

Similar technique has been utilized during the war, in the production of name plates to replace those hitherto made of critical metals, translucent instrument panels and permanently mounted instructions and diagrams for servicing military equipment.

The improved heat resistance of melamine laminates, particularly in translucent form, will undoubtedly expand the use of such products in the field of lighting, and the improved weathering resistance imparted by melamine will permit, after the war, the use of laminates for exterior applications.

There are other examples of prewar applications which are contributing to the war effort. In combination with alpha cellulose, molding compositions were developed before the war in pearl and a limited range of bright stable colors. These were used for the holding of wash buttons which, after repeated laundering, preserved their original gloss and general appearance. The alpha cellulose molding material was also found well suited for use in molding tableware where its hardness and stain resistance were its principal advantages. During the war the military services have utilized melamine buttons for wash garments. Due to its light weight,

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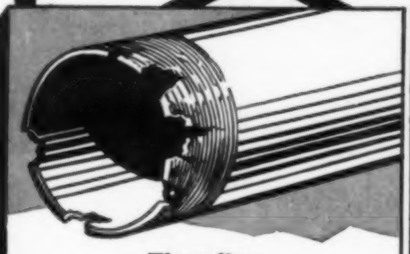

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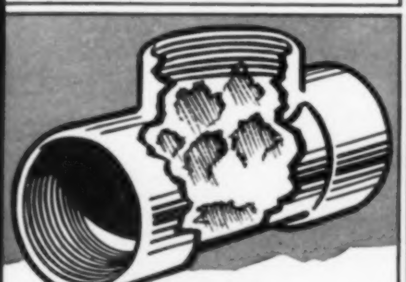

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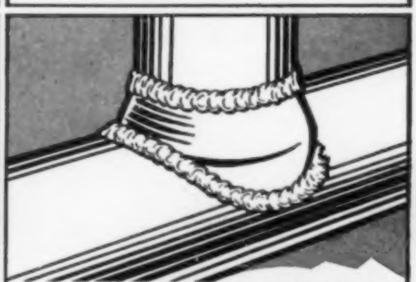

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combined with relative lack of fragility, molded tableware has been utilized by the Navy for overseas stations, light vessels, and aircraft use. More recently, a number of the molders in the States have been producing compartment mess trays with a medium impact, fabric-filled melamine molding composition.

A more recent application for melamine resin has been in hot set waterproof glues for plywood, and laminated wood. Its outstanding characteristic is the strength of the glue line when under tension and in shear; combined with water resistance far surpassing the requirements for aircraft plywood.

The use of melamine in glues provides an excellent example of an unique property of melamine. It has been found that the addition of relatively small proportions of melamine resins to urea resins produces glues of bonding quality very much superior to that of the urea glues themselves.

Numerous applications, other than in plastics, demonstrate the ability of melamine when used in small proportions, to impart special properties to other products without modifying their fundamental characteristics-texture, form, etc.

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Another example of the use of melamine resins in relatively small proportions to impart specific properties is in the treatment of textiles. These resins, in water solutions, have been used to render fabrics creaseproof, in the shrink-proofing of cotton, rayon and woolen fabrics, as stiffening agents in mosquito and camouflage netting, and as hardening agents to modify polyvinyl butyral and other elastomers, in impermeable coatings.

The alkylated melamine resins produced by reaction with alcohols have been used extensively, particularly before the war, as components of baking enamels. It is anticipated in the postwar period that this application will increase in volume. In these enamels, melamine resins contribute, not only extreme hardness, but curing speed, color retention, resistance to heat and weather, and the action of many chemicals and solvents.

Melamine resins are used in many strictly plastic applications, as well as in products that are in no way directly related to plastics. In all instances melamine

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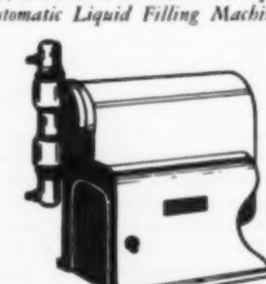

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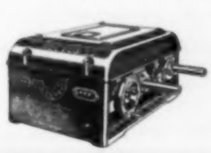

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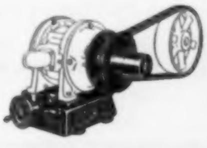

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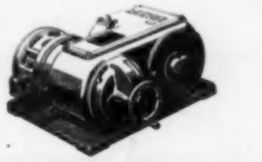

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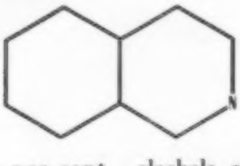

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C. J. Romieux, American Cyanamid Co., before Canadian Section, Society of the Plastics Industry, Jan. 25th, 1944.

ELECTROLYTIC TUNGSTEN

Tungsten ore today occupies a major position among strategic minerals. Few minerals have increased so rapidly in importance within the last twenty years. In the case of tungsten this has been mainly due to an increase in the use of hard alloy steels rather than to the introduction of new applications of tungsten metal.

On account of the metal's several unique properties, tungsten is being used as pure metal, as alloy constituent, and in chemical compounds. Its use as pure metal is especially due to its high melting point of 3,370 deg. C., the highest of any metal. It is practically the only metal now used for incandescent lamp filaments. A combination of physical properties—tensile strength, hardness, melting point, ductility, corrosion and erosion resistances—of this metal accounts for its efficient service as the major and essential constituent in making high speed steel which plays a most important role in the tool industry. Tungsten is also used for electrodes for atomic hydrogen welding, in tungsten arc lamps, and for electrical contacts in automobile engines. Pure tungsten is employed as a heating element in electric resistor furnaces, in the form of wire and ribbon; in gas-discharge lamps, and in radio tubes. For leading-in wires through special borosilicate glass, its low thermal expansion is of importance. The fact that the tensile strength and modulus of elasticity of fine tungsten wire are the highest of any metal invite its use in measuring instruments. Tungsten compounds are used in the arts as mordants, pigments and fireproof materials. Finally, tungsten carbide tools are used in machine shops on account of the carbide's extreme hardness.

Only two tungsten minerals are of commercial importance, namely, wolframite $(Fe,Mn)WO_4$, and scheelite, $CaWO_4$. Wolframite with high iron content is termed ferberite; and with high manganese content, huebnerite. The largest and richest tungsten deposits are in Asia. China has been dominating the tungsten market since 1916. Despite the war, China's 1941 production outstripped that of any other country and China remained the world's largest producer of tungsten ore.

As a result of a large number of tests, it was invariably found that the WO_3 content of tungsten ores will dissolve in fused alkali borates and alkali phosphates. Furthermore, these baths are good conductors of electricity and produce pure tungsten metal at the cathode at relatively high current efficiencies. Different types of ores which included wolframite, ferberite, huebnerite and scheelite were

tried and proven to be satisfactory. The tungsten in the ore used does not require preliminary transformation into alkali tungstate as in the older processes. The process can be applied not only to high grade ore concentrates but also to low grade ores and concentrates.

For the fused borax bath using wolframite as the source of tungsten, the results were: (1) best composition of electrolyte, 1¼ parts, $Na_2B_4O_7$ per 1.0 part of ore concentrate; (2) operating temperature, 1,050 to 1,300 deg. C.; (3) optimum current density, 50 amp. per sq.dm.; (4) best current efficiency obtained, 78.23 percent; (5) best yield, 417.5 g. per kwh.; and (6) best quality of tungsten produced, 99.57 percent W.

For the fused phosphate bath using wolframite as the source of tungsten, the results were: (1) best composition of electrolyte, 1.75 parts phosphate mixture (7 mols $Na_4P_2O_7$ + 3 mols $NaPO_3$) per 1.0 part of ore concentrate; (2) operating temperature, 1,050 to 1,300 deg. C.; (3) optimum current density, 50 amp. per sq.dm.; (4) best current efficiency obtained, 80.96 percent; (5) best yield, 505.1 g. per kwh.; and (6) best quality of tungsten produced, 99.7 percent W.

The tungsten metal produced from either the fused borate or the fused phosphate bath is free from impurities, present in the tungsten ores, such as phosphorus and arsenic, which must be absent according to rigorous specifications laid down by the tungsten steel producers.

Colin G. Fink, Columbia University, and Chuk Ching Ma, Westinghouse Lamp Co., Bloomfield, N. J., before the 84th general meeting of the Electrochemical Society, New York, N. Y., Oct. 14, 1943.

INHIBITORS

CERTAIN chemicals, when they are added to a corroding solution in small amounts, have the property of reducing the total amount of corrosion of metals. Such chemicals are called corrosion inhibitors. Thus the chemical is termed an inhibitor if the following expression has a positive value but an accelerator if it has a negative value.

$$P = \frac{W_1 - W_2}{W_1} \times 100$$

where W_1 is the weight loss of a metal specimen after some definite period of exposure in a corroding solution and W_2 is the weight loss of an identical specimen exposed for the same length of time in a similar solution to which a small amount of some of the chemical in question has been added. The chemical would be an effective inhibitor if P had a high value, say +80 or +90 and a weak inhibitor if the value were only +10 or +20.

Further classifications of inhibitors are also useful. If the attacked area of the specimen exposed to the inhibited solution is larger than the attacked area of a similar specimen exposed to the uninhibited solution, the inhibitor is classed as "expansive." If the attacked area is smaller for the specimen exposed to the inhibited liquid, the inhibitor is "contractive." Similarly, if the depth of attack at those areas of the specimen which do corrode is smaller for the specimen exposed to the inhibited solution than for the specimen exposed to the uninhibited solution, the inhibitor

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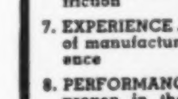

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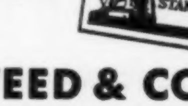

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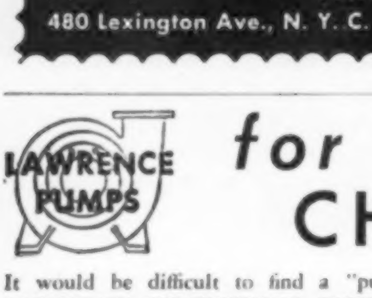
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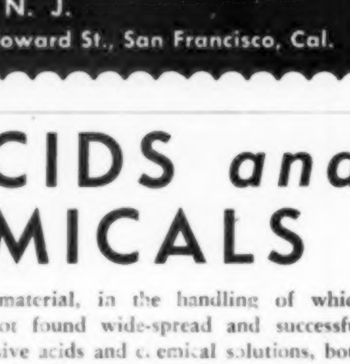
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would be classed as "safe," whereas if the reverse were true, it would be classed as "dangerous."

Thus the following classifications of effective inhibitors are possible: expansive, safe inhibitors; contractive, safe inhibitors; contractive, dangerous inhibitors. The class, expansive, dangerous inhibitors does not exist because such a chemical would be an accelerator.

It is of value to attempt to explain why a given chemical falls into one or the other of these classes. In all cases where corrosion is an electrochemical phenomenon, the rate of attack will be proportional to the current flow between the local anodes and cathodes. Thus,

$$D = kI$$

where D = rate of attack, and I = current flow. The magnitude of the current at any instant is determined by the open circuit potential difference between the local anodes and cathodes, the anode and cathode polarization and the electrical resistance of the liquid path between the anodes and cathodes. Otherwise expressed

$$I = \frac{E - (E_a - E_c)}{R}$$

Where E = open circuit potential between the local anodes and cathodes, E_a = anode polarization, E_c = cathode polarization, and R = resistance of the liquid path. Thus, from the electrochemical standpoint, in order for an inhibitor to be effective it must do one or more of the following: (1) Increase the resistance (R) of the electrolytic path between the local anodes and the local cathodes. (2) Increase the polarization (E_a) of the local anodes. (3) Increase the polarization of the local cathodes (E_c). (4) Decrease the open circuit potential difference (E) between the local anodes and the local cathodes.

If an inhibitor functioned solely by increasing the resistance of the electrolytic path and did not affect the area of the local anodes, it would be a safe inhibitor. If the anodic area were decreased, as long as the decrease in anode area did not exceed the rate of decrease in local current flow, it would still be a safe inhibitor.

If the inhibitor increased the polarization of the local anodes but did not affect other factors, especially the anode area, the inhibitor would be classed as safe. However, if it reduced the anode area faster than it increased anodic polarization, it might be dangerous.

Actually, inhibitors very seldom have only one of the four effects. Generally, the addition of an inhibitor will cause simultaneous alterations in anode and cathode polarization, in resistance of the electrolytic path, and in open circuit potential difference between the local anodes and the local cathodes. Thus the mechanism of inhibitor action in any specific case is likely to be exceedingly complicated. It is much easier to state how an inhibitor behaves than to account for the way of its behavior. Because of the difficulty, relatively few tests have been made to evaluate reasons for inhibitor action.

R. B. Mears and G. G. Eldredge, Aluminum Research Laboratories, New Kensington, Pa., before the 83rd general meeting of the Electrochemical Society, Pittsburgh, Pa., April 8-10, 1943.

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FOREIGN LITERATURE ABSTRACTS

LITHIUM IN ALUMINUM ALLOYS

Considerable interest in light and nonferrous metal alloys containing lithium has developed within the last ten years. The addition of several hundredths of one percent of lithium to copper, for example, improves the mechanical properties to a surprising degree. Alloys of aluminum with zinc and lithium show properties comparable to those of soft steels.

Original work was conducted in the metallurgical laboratory of the Institute of General and Inorganic Chemistry of the Academy of Science (USSR) on the properties of various alloys of aluminum, zinc and lithium. The accompanying table shows the compositions used and the type of treatment to which the alloys were subjected. Aluminum-zinc alloys containing 6-24 percent zinc were also investigated.

Aluminum alloy containing 11.89 percent zinc and 0.11 percent lithium, for example, has the following properties after being annealed: elongation of 33.5 percent, temporary resistance to rupture of 20 kg. per sq.mm., Vickers hardness of 70, and an Ericksen index of 8-9 units for a sheet 1 mm. thick. The alloy with 5.6 percent zinc and 0.4 percent lithium had the following properties: elongation of 25.7 percent, temporary resistance to rupture of 10 kg. per sq.mm., hardness of 31, an Ericksen index of 9 units. After hardening and natural aging, the second alloy has a temporary resistance to rupture of 22 kg. per sq.mm. and a hardness value of 57. Resistance of these alloys to corrosion in sea water decreases with an increase in lithium content up to composition IV (see table) after which it increases again.

Digest from "Mechanical Properties of Alloys of Aluminum with Zinc and Lithium," by T. A. Badaev and F. I. Shamrey, *Zhurnal Prikladnoi Khimii* XVI, No. 5-6, 161-172, 1943. (Published in Russia.)

BORON IN CERAMICS

Borates and boric acid are used in producing glazes on all types of ceramic ware, from porcelain dishes to earthenware pipes. Boric oxide improves the appearance and color of enamelled hardware. It also tends to decrease the coefficient of expansion so

Thermal Treatment of Aluminum-Zinc and Aluminum-Zinc-Lithium Alloys

		Hardening and Natural Aging		Hardening and Artificial Aging		
	Annealing Temp., deg. C.	Hardening Temp., deg. C.	Aging Time, days	Hardening Temp., deg. C.	Aging Temp., deg. C.	Aging Time, hr.
Cross-Sections						
Al-Zn Alloys	350	350	10	350	75	42
I Zn:Li = 104:1	350	350	10	350	75	42
II Zn:Li = 37.5:1	350	350	10	350	75	42
III Zn:Li = 13.9:1	450	450	10	450	125	48
IV Zn:Li = 4:1	450	550	10	550	125	46
VII Zn:Li = 1:1.3	450	580	10	580	150	42

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that objects finished with such a frit are more resistant to considerable changes in temperature and have greater elasticity. Glazed finishes containing boron oxide are resistant to solutions of alkalis and salts such as caustic soda, ammonia, carbonates, phosphates, chlorides, sulphides and even to acid solutions if the proportion of boron oxide to silicon dioxide is proper. Boron products, especially borax, can largely supplant lead compounds in ceramics which is advantageous both in that the quality of the glaze is improved and that the boron is not toxic.

A mixture of 90 percent salt and 10 percent borax gives best results for earthenware pipes. A refractory material with optimum chemical resistance is made with 0.3 percent borax and 1.3 percent boric acid added to the refractory mass. Refractory bricks for furnaces are finished by impregnation with 200 parts borax, 225 parts litharge and 120 parts fine sand. This mixture is applied in the form of a paste and baked on at 900-1000 deg. C.

Digest from "Boron Products in the Industries," by E. F. Gobel, *Revista de Quimica Industrial* XII, No. 137, 16-21, 1943. (Published in Brazil.)

KETONE MOTOR FUELS

The first ketone motor fuel, known as "Ketol," to be introduced into industry is obtained by dry distillation of the calcium salt of organic acids from the butyric acid fermentation of sugar solutions. This product, a clear liquid of unpleasant odor with a heat value of 9,200 cal., is a mixture of acetone, propyl ketone and other ketones with varying amounts of isobutyl and amyl alcohols and aldehydes.

Fischer's "Synthal" contains ketones, including acetone. Recent investigations have shown that acetone is suitable for motor fuel. It has an octane number of 98, latent heat of vaporization of 526 joules per gram and a heat value of 6,959 cal. Also suitable are certain of the higher homologs of acetone, including methyl ethyl ketone, which has an octane number of 99. Lower ketones are especially suitable as blending agents for aviation fuel. A mixture of 30 parts of ketone, 70 parts of gasoline and 0.6 parts of tetraethyl lead has an octane number of 100.

Italian patent 350,427 describes a process for making acetone oil by fermentation of molasses to lower fatty acids and then catalytically ketonizing the acids in the vapor phase at 300 to 500 deg. C. with steam.

Digest from "Ketone Motor Fuels," *Oel und Kohle in Gemeinschaft mit Brennstoff-Chemie* 39, Sch. 138, 1943. (Published in Germany.)

GAS PURIFICATION

While the ferric hydrate content of natural iron oxide is the most important factor in removal of hydrogen sulphide from coal gas, much exact information is missing from most discussions on this essential phase of the gas industry. Until recently, it was assumed that the ferric oxide content roughly indicated the reactivity of an oxide. Then it was realized that the water of hydration exerted a definite influence, and so it has been the practice of the Australian gas industry to use, for hydrogen sulphide removal, oxide from Port Macquarie containing 6 percent or

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In natural iron oxide from Port Macquarie, the active portion for hydrogen sulphide absorption is the hydrated oxide, comprising approximately 50 percent by weight of the total oxide. Optimum conditions for hydrogen sulphide absorption by this oxide are 6.5 to 7 percent moisture and 29–32 deg. C. Acidity in the purifiers lessens the activity of Port Macquarie oxide. The optimum hydrogen ion concentration is within the range 6 to 8. By heating the oxide above 500 deg. C., no stable hydrate is re-formed when the oxide so treated is brought into contact with water, and the reactivity of the oxide is substantially reduced. On heating through a temperaure range of 500 to 700 deg. C., an irreversible change occurs with a corresponding loss in activity for hydrogen sulphide absorption.

It has been found possible to convert chemically the inactive rhombohedral form of oxide into the active cubic form. In addition, it has been shown that the chemically converted oxide has a greater activity for hydrogen sulphide absorption than the original oxide. An inert filler of the nature of granulated refractory insulating brick was found to give the desired porosity to minimize back pressure without development of caking in service or decomposition during roasting. The use of ferric hydrate chemically prepared from natural iron oxide is considered to have definite advantages for plant conditions.

War conditions emphasize the need for additional experimental work on the suggested method of sulphur removal in order to conserve oxide stocks and to make available for Australia a large tonnage of sulphur, a commodity which will become more valuable as imports become more difficult.

Digest from "The Fundamentals of Dry Purification of Towns Gas" by E. McLeish. *Journal and Proceedings* of the Australian Chemical Institute **10**, No. 8, 198–218, 1943. (Published in Australia.)

BARIUM PEROXIDE

Commercial grade barium peroxide always contains a small proportion of barium oxide which is not the result of secondary dissociation, since at the temperature of the oxidation no dissociation pressure can be measured. It appears to be caused by some slight lack of porosity of the initial oxide and to the presence of certain impurities, such as iron oxides, which catalyze the decomposition of the barium peroxide. As a result, commercial material may contain some 10 percent of the lower oxide. Attempts to oxidize this by after-treatment have been unsuccessful. It was thought at first that washing the product with water would bring about hydration and that on subsequent drying considerable decomposition would occur.

If barium peroxide hydrate is dried at a temperature of over 200 deg. C., decomposition occurs, but the speed of hydration is very slow. If temperatures under 40 deg. C. are maintained during the period of contact with water, the proportion of hydrate formed after 15–20 minutes is negligible. Experiments were carried out to find out what volume of water and method of washing were most appropriate

to the purification of this material. This involved repeated washings with fresh or previously used water. In this way the peroxide content of impure material can be raised some 5 percent without appreciable loss.

Digest from "Barium Peroxide," by E. V. Drathen and H. Walther, *Chem. Z.*, 119, March 1942. (Published in Germany.)

ALIPHATIC HYDROCARBONS

METHANE can be oxidized with air to form a certain amount of formaldehyde, but the process still awaits large-scale development in Germany. Methane can also be converted to a mixture of carbon monoxide and water, and plants for making motor fuels could probably be operated alongside natural gas fields. Ethane oxidation, which has not been carried out on a commercial scale, yields formaldehyde, formic acid and some acetic acid. The oxidation of propane and butane with air has been given considerable attention but no feasible process has yet been developed. It is undoubtedly possible to produce certain alcohols or aliphatic acids, although the yields are poor. Low temperatures and high pressures promote the oxidation process.

Oxidation of olefines produces olefine oxides. Although many suggestions have been made for the preparation of ethylene oxide from ethylene and air with the aid of silver catalyst, it still has not yet been proved that such process would be feasible on a large scale.

Olefines can be dimerized or trimerized with the help of catalysts or inorganic acids to yield gasoline-like materials. They can also be polymerized with catalysts such as benzoyl peroxide or boron fluoride to substances having molecular weights up to 500,000. Ethylene and propylene can be made to yield lubricating oil or wax-like materials by polymerizing with phosphoric acid, phosphorus pentoxide or aluminum chloride under pressures of several thousand atmospheres and at temperatures of 200-300 deg. C. Purity of the olefines, especially from hydrogen, is very important for the polymerization. Isobutylene can be polymerized at temperatures as low as —80 deg. C., with boron fluoride catalyst, into gum-like synthetics. These are known in industry as "Oppanol" and are used for lining chemical apparatus.

Digest from "The Utilization of Lower Aliphatic Hydrocarbons," by C. T. Kautter, *Die Chemie* 56, 225, 1943. (Published in Germany.)

CELLULOSE ESTERS

BY USING phosphoric instead of sulphuric acid in the nitration acid mixture, degradation of the cellulose is avoided; the degree of polymerization as the other essential viscosity-influencing factor is thus eliminated. It was found that under such conditions—confirming the results reported by previous investigators—the viscosity increases with increasing degree of substitution, probably as a result of increasing solvation (increasing particle volume) in the solvent.

Digest from "The Influence of the Degree of Substitution Upon the Viscosity of Cellulose Nitrates," by H. A. Wannow, *Kolloid-Z.* 102, No. 1, 29–34, Jan. 1943. (Published in Germany.) [From Bulletin of the Institute of Paper Chemistry, 13, No. 11, 429, July 1943.]

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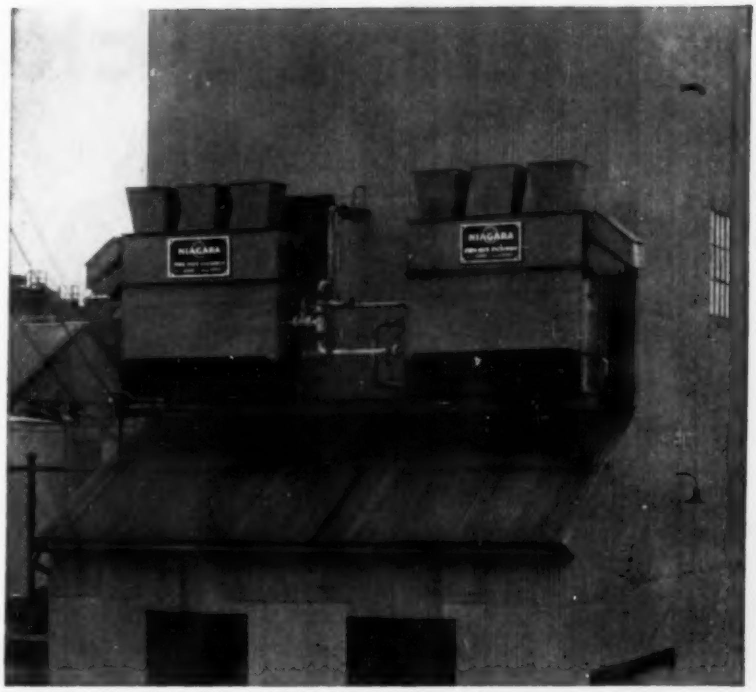

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PLASTICS ANNUAL

PLASTICS CATALOG, *1944 edition. Published by Plastics Catalogue Corp., New York, N. Y. 990 pages. Price $6.*

THIS is the usual fine annual issue of the catalog which contains much of the material of interest to everyone in the plastics industry or concerned with these products and their raw materials. All sections of the volume have been revised and brought up to date. Some rearrangements have been made. Many of the data have been put on large fold-in charts. The only adverse comment has to do with the large charts. So many interfere with ease in referring to material in the book and in addition these large charts are awkward to handle and if folded and unfolded many times are soon destroyed. The catalog includes not only solid plastics but coating materials, laminates, synthetic fibers and synthetic rubbers.

MODERN CONCEPTS

ELECTRONIC INTERPRETATIONS OF ORGANIC CHEMISTRY. *By A. Edward Remick. Published by John Wiley & Sons, Inc., New York, N. Y. 474 pages. Price $4.50.*

Reviewed by F. C. Nachod

THERE are a number of books dealing with the physical chemistry of organic compounds, such as Hueckel's "Theoretische Grundlagen der Organischen Chemie," Waston's "Modern Theories of Organic Chemistry," and Hammett's "Physical Organic Chemistry." Your reviewer was therefore surprised and somewhat doubtful with respect to duplication of effort when he was asked to review this treatise. He is now very enthusiastic and pleased to recommend this text by Dr. Remick wholeheartedly to anyone who wishes to obtain quickly a good understanding of modern organic chemistry concepts.

The reason for this enthusiasm was substantiated by a discussion with an organic chemist friend who pointed out that most other treatises approach the field from the view point of the physical chemist. This book however is written with the organic chemist's viewpoint and carefully builds up from it. The mathematical treatment which, of course, is necessary in certain parts of such a subject is nevertheless strict and definite.

The introduction is based on the historical development of various concepts. Following chapters are on the Lewis theory, on the contributions of the English school (Ingold, Sidgwick, Watson and others). Electron- pairing and sharing reactions as well as solvent roles are adequately treated.

The purpose of the book is a dual one, a review and an advanced textbook." Your reviewer feels that Dr. Remick certainly has accomplished both goals. Especially good are the appendixes which cover such topics as Refractivity and Chemical Constitution, Dipole Moments, and so forth. A table of Basic Principles is found at the end of the book and reference is made to this table throughout the text. The author has achieved a truly remarkable correlation not found in any other text on this subject.

The absence of an author index and 18 typographical errors noted (the name Sidgwick is consistently misspelled) are the only criticism The book will probably soon see its second edition and it is hoped that these two comments will have been helpful.

In conclusion your reviewer would like to say that he has read a very fine book and that he believes that it will rank with the foremost texts of the field.

RECENT BOOKS RECEIVED

Basic Mathematics for War and Industry. By P. H. Daus, J. M. Gleason & W. M. Whyburn. Macmillan. $2.

The Chemistry of Synthetic Substances. By E. Dreher. Philosophical Library. $3.

The Constituents of Wheat and Wheat Products. By C. H. Bailey. Reinhold. $6.50.

Ferrous Metallurgy. Vols. I & II. 2nd ed. By E. J. Teichert. McGraw-Hill. $4 per vol.

The Physical Chemistry of Electrolytic Solutions. By H. S. Harned & B. B. Owen. Reinhold. $10.

Protective and Decorative Coatings. Vol. IV. By J. Mattiello. Wiley. $5.

Quantitative Analysis. 2nd ed. By H. S. Booth & V. R. Damerell. McGraw-Hill. $2.50.

A Survey of General and Applied Rheology. By G. W. Scott Blair. Pitman. $4.

EMULSION REPRINTS

EMULSION TECHNOLOGY, THEORETICAL AND APPLIED, INCLUDING A SYMPOSIUM ON TECHNICAL ASPECTS OF EMULSIONS. *Published by Chemical Publishing Co., Brooklyn, N. Y. 290 pages. Price $5.*

Reviewed by Jerome Alexander

A BRIEF "Preface" by H. Bennett states: "The symposium on emulsions, held by the Leather Trades Chemists, brought together some of the foremost European colloid chemists. The papers, presented at this symposium, were published under the title of Technical Aspects of Emulsions. This useful book ran to three editions and is now out of print. Because of the numerous requests for it and because of new developments in emulsion technology, it was decided to bring out a new edition with certain revisions and additions—the latter by American specialists."

The bulk of the book (pp. 228) consists of the reprinted articles. The original date of publication is not stated, but since none of these articles have references later than 1934, the date seems to be 1934 or 1935. The reprinted "Foreword" (pp. 2) by Prof. F. G. Donnan, states: "This volume contains the papers read at the second Symposium held by the British Section of the International Society of Leather Trades' Chemists." Dr. William Clayton's reprinted paper (pp. 27) on "Emulsions in the Patent Literature" includes a few 1934 patents, and the fourth edition of Clayton's well known "Theory of Emulsions" has an Appendix, "Summary of Important Patents Since 1934." And in his "Preface" to his fourth edition Clayton states: "The British Section of the International Society of Leather Trades' Chemists held a symposium in London in 1937, the papers with my Forword being published later in a volume entitled 'Wetting and Detergency.' Its relation to emulsions is obvious."

Relative to the new articles: "The Fundamental Principles of Practical Emulsion Manufacture," (pp. 26) by R. M. K. Cobb states (p. 8): "It is the object of this chapter to outline the principles of practical emulsion manufacture in a very general way. The actual formulation and production of industrial emulsions is covered elsewhere in this volume by Hofmann, q.v." Miss Cobb's paper contains many practical suggestions; e.g., (p. 27): "A successful trial of an emulsion in a five gallon can, before going on to more ambitious commercial batches, is highly advisable. Problems of procedure, which cannot be suspected in a 500 cc. beaker formulation, show up in the five gallon batch." The paper by M. P. Hofmann, "Industrial Emulsion Formulation" (pp. 21) states (p. 66): "Only practical applications of colloidal principles and practical working emulsion formulae will be discussed in this section...As the list of chemicals, compounds, by-products, and other materials, having potentialities as dispersants and protective colloids, is very long and is being daily augmented, only the best known of these materials will be discussed in this section." The sixteen typical formulations include furniture polish, mineral oil emulsions, and mayonnaise, and the procedure is well outlined. [Hydration appears confused with hydrolysis in the statements: "...hydrolyze the glue in part of the water" (p. 82), and "Soak gums until they are well hydrolyzed..." (p. 83).]

"Emulsion Paints," by S. Werthan (pp. 15) states (p. 213): "Several years ago, the casein paint manufacturer, in order to improve his product, incorporated a small percentage of an oxidizing oil into his paste-paint. This may be considered the start of the present-day oleoresinous emulsion paste-paints...It is with the thought that through the publication of the results of practical tests, the increase in the technical knowledge on the subject will be expedited, that this brief discussion of some of the

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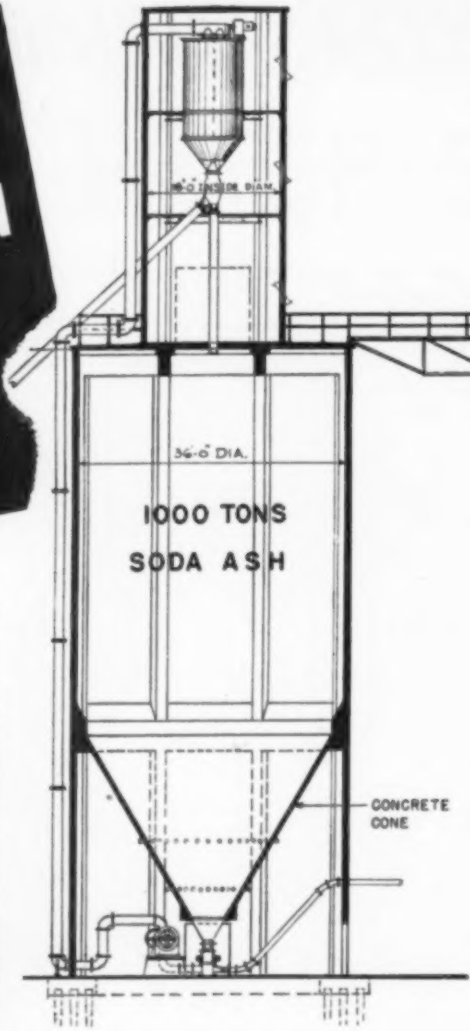

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tests made will be presented."..."Special machines, colloid mills, homogenizers and emulsifying machines, are frequently used in the manufacture of emulsions. The equipment of the average American paint plant does not include any of these machines. However, it did not take long for the paint manufacturer to learn how to prepare his paint emulsions with his available equipment."

The statements of the three new contributors do no appear to justify the claims on the jacket that the book "discusses the new developments in emulsions," and contains a "comprehensive list of commercial emulsifying agents." It is a pity that the ten-year-old papers were not brought up to date before being reprinted, for this would have greatly increased the value of the book.

PHYSICAL CHEMISTRY TEXTBOOK

OUTLINES OF PHYSICAL CHEMISTRY. *Seventh edition. By Frederick H. Getman, revised by Farrington Daniels. Published by John Wiley & Sons, New York, N. Y. 691 pages. Price $3.75.*

THE ORIGINAL Getman "Outlines" appeared more than 30 years ago and since that time, in various editions, has become a standard textbook of physical chemistry. The present revision by Dr. Daniels involves rearrangement, addition of more advanced material and, of course, inclusion of new developments. There is also "a somewhat different approach to thermodynamics and the phase rule." Practical applications are emphasized with the help of frequent examples.

Recent Books & Pamphlets

Industrial Alcohol. Special Report of the U. S. Tariff Commission prepared for the Ways and Means Committee of the House of Representatives. 67 pages. A statistical review of the present interest in raw materials, plant locations, output and postwar prospects. Primary purpose of the report is to give facts and figures bearing on the probable postwar standards of the United States industrial alcohol industry.

Wage Incentives in Wartime. Published by Consolidated Management Consultants, 5 Fifth Ave., New York 18, N. Y. A guide to increased production without extra manpower.

Vladimir M. Ipatieff, testimonial in honor of three milestones in his career. Published by Universal Oil Products Co., Chicago 4, Ill.

A Yearbook of Railroad Information. 19 edition. Published by the Committee on Public Relations, Eastern Railroad Presidents Conference, 143 Liberty St., New York 6, N. Y. 96 pages. Gratis. Facts regarding the railroads of the United States giving statistics (1921-1942) regarding the railroad plants and its operations.

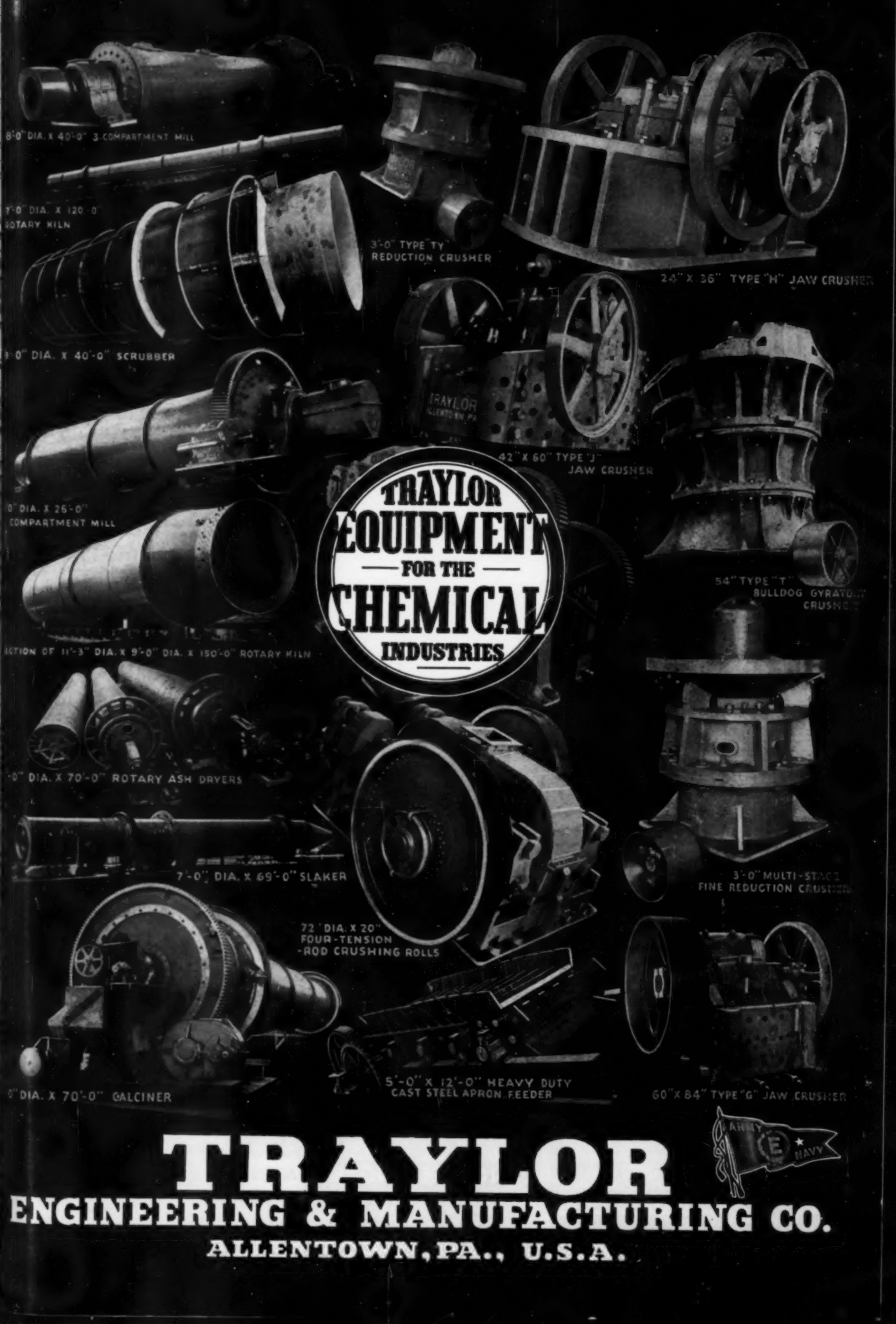
Modern pH and Chlorine Control. Published by W. H. Taylor & Co., 7300 York Road, Baltimore 4, Md. 83 pages. Sixth edition. Theory and applications of pH control together with description of all Taylor equipment for pH, chlorine and phosphate control and water analyses.

Bibliography of North American Geology 1919-1928. By J. M. Nickles. Geological Survey, Bulletin 823. Price $1.25.

New World. Published by United States Testing Co., Inc., Hoboken, N. J., 24 pages. Gratis. An attempt to give industry a brief over-all answer to this question, "What can the scientist do for us?"

Channel Blacks in Butyl Rubber. Published by Continental Carbon Co., 295 Madison Ave., New York, N. Y. 10 pages. Gratis. Test procedure and results on a GR-I test formula containing 50 parts channel black.

Practical Design of Welded Steel Structures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By H. M. Priest. Published by American Welding Society, 33 W. 39th St., New York, N. Y. 153 pages. Price $1. Concise essentials of welding and welded construction.

Blends of Standard Channel and Semi-Reinforcing Furnace Blacks to Match Processing Channel Blacks. Report SRF No. 1, Published by Continental Carbon Co., 295 Madison Ave., New York, N. Y. 16 pages. Gratis. Properties of blends of medium processing channel black and semi-reinforcing furnace black compared with easy processing channel black in a typical rubber GR-S tread compound.

Scientific Research and War Effort of USSR. By J. E. Tolpin, Universay Oil Products Co., Chicago, Ill. 3 pages. A reprint from *Science*.

Synthetic Liquid Fuels. Available from Government Printing Office, Washington, D. C. 470 pages. Price 70 cents. Report of the hearing before the Public Lands Committee of the Senate on S-1243. A volume giving expert opinion from well-informed American sources on the prospects of liquefaction of solid fuels to make synthetic petroleum and petroleum products.

The Smiths and Their Wartime Budgets. By Maxwell S. Stewart. Pamphlet No. 88 published by Public Affairs Committee, 30 Rockefeller Plaza, New York 20, N. Y. 32 pages. Price 10 cents. Abbreviated history of rationing with comparisons to the inflation of World War I.

As We Win. CIO Publication No. 98, available from Congress of Industrial Organizations, 718 Jackson Place, Washington 6, D. C. Price 5 cents. Report No. 1 of the CIO Postwar Planning Committee.

Felt Facts. Published by the Felt Association, 366 Madison Ave., New York 17, N. Y. 22 pages. History, manufacture and uses of felt.

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. In ordering any publications noted in this list always give the complete title and the issuing office. Remittances should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper covers unless otherwise specified. When no price is indicated, the pamphlet is free and should be ordered from the Bureau responsible for its issue.

Statistics of Natural Gas Companies, 1942. FPC S-33. For sale only by Federal Power Commission, Washington 25, D. C. Price 50 cents.

United States Consumption of Food in Terms of Fats, Protein, Carbohydrates, and Calories, 1939-1943. Available from U. S. Tariff Commission, Washington 25, D. C.

United States Government Manual Winter 1943-44. Office of War Information. Price $1.00.

Reconstruction Finance Corporation Act as Amended and Other Laws Pertaining to Reconstruction Finance Corporation. Revised to September 1943. Price 20 cents.

United States Production, Consumption and Stocks of Chemicals 1941-1943. "Facts for Industry" Series 6-1-1. Obtainable from Bureau of the Census, Washington 25, D. C.

Monthly Production of Softwood Plywood, and Consumption and Stocks of Materials, 1941-1943. "Facts for Industry" Series 16-1-1. Obtainable from Bureau of the Census, Washington 25, D. C.

Census of Pulp Mills and of Paper and Paperboard Mills, 1942. "Facts for Industry" Series 24-1-1. Obtainable from Bureau of the Census, Washington 25, D. C.

Statistical Abstract of the United States, 1942. Census Bureau. Price $1.75. Buckram.

Topographic Maps. Geological Survey. Sale of the standard topographic maps of the Geological Survey for areas within the continental United States (excluding Alaska) and Puerto

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Rico has been resumed. Therefore, beginning with the list of "Publications issued in January 1944," the maps issued each month will be announced in the monthly lists. A consolidated list of the maps published between March 1, 1942, and Dec. 31, 1943, inclusive, is being prepared and will be printed as soon as possible. A copy of that list will be sent automatically to all those who receive the monthly announcements of new publications, and those persons should not submit special requests for it. Others who desire copies of the consolidated list may submit requests, which will be honored when the list is printed.

Coatings That Prevent End Checks. Technical Note No. 186. Available from Forest Products Laboratory, Madison, Wisconsin.

Wood and Paper-Base Plastics. By Alfred J. Stamm. Mimeo No. R1438. Available from Forest Products Laboratory, Madison, Wisconsin.

Suitability of Birch, Aspen, and Sugarberry for Rayon Pulp: Results of Certain Sulfite Pulping and Bleaching Experiments. By Hugo Nihlen and J. N. McGovern. Mimeo No. R1441. Available from Forest Products Laboratory, Madison, Wisconsin.

Fire-Retarding Coatings. By Arthur Van Kleeck. Mimeo No. R1280. Available from Forest Products Laboratory, Madison, Wisconsin.

Suggestions and Instructions for Kiln Operators Drying Aircraft Lumber. By Glenn Voorhies and W. Karl Loughborough. Mineo No. 1362. Available from Forest Products Laboratory, Madison, Wisconsin.

Increasing the Durability of Casein Glue Joints with Preservatives. By F. H. Kaufert. Mimeo No. 1332. Available from Forest Products Laboratory, Madison, Wisconsin.

Wood's Technological Coming-of-Age. By F. J. Champion. Mimeo No. 1442. Available from Forest Products Laboratory, Madison, Wisconsin.

Marketing Vermiculite. By G. Richards Gwinn. Bureau of Mines, Information Circular I. C. 7270. Mimeographed.

Use and Misuse of Flame Safety Lamps. By W. H. Tomlinson. Bureau of Mines, Information Circular I. C. 7271. Mimeographed.

Analyses of Crude Oils from Some West Texas Fields. By Boyd Guthrie. Bureau of Mines, Report of Investigation R. I. 3744. Mimeographed.

Report of the Administrator of Agricultural Research 1943. Agricultural Research Administration. Includes the annual reports of the subsidiary agencies, which are: The Bureaus of Agricultural and Industrial Chemistry; Animal Industry; Entomology and Plant Quarantine; Human Nutrition and Home Economics; Plant Industry, Soils, and Agricultural Engineering; and the Office of Experiment Stations. Price 25 cents.

The Explosion and Fire Hazard in Handling Ammonium Nitrate as a Fertilizer. By R. O. E. Davis. Agricultural Research Administration. Available from Bureau of Plant Industry, Soils and Agricultural Engineering, Beltsville, Maryland. Mimeographed.

Cotton Quality Statistics United States 1942-43. War Food Administration. CS-5. Price 15 cents.

Dairy and Poultry Market Statistics 1942. War Food Administration. CS-4. Price 15 cents.

Commercial Standards. National Bureau of Standards. Price 5 cents each. Items as follows: Structural Fiber Insulating Board, CS42-43. Homogeneous Fiber Wallboard, CS112-43. Earthenware (Vitreous-Glazed) Plumbing Fixtures, CS111-43. Bituminized-Fibre Drain and Sewer Pipe, CS116-44. Tire Repairs-Vulcanized (Passenger, Truck and Bus Tires), CS110-43. Textiles-Testing and Reporting, CS59-44.

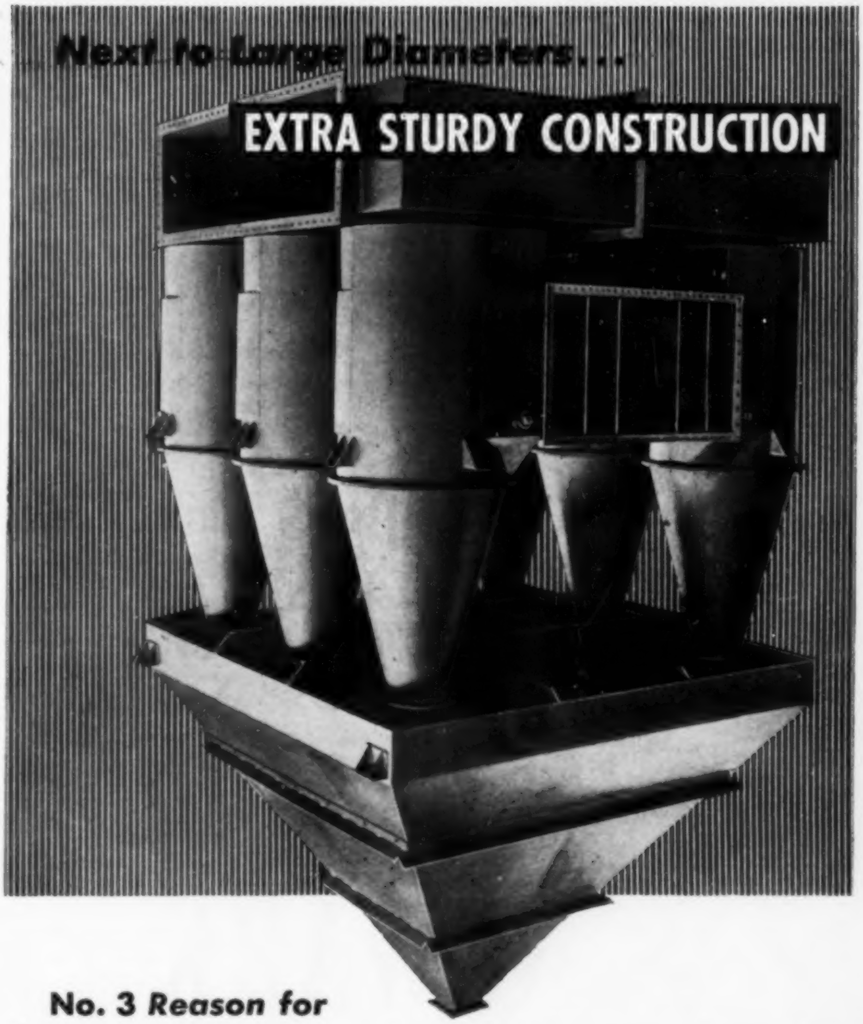
Service Tests of Some Oil-Treated Sole Leathers. By Robert B. Hobbs and Howard E. Bussey. Bureau of Standards. Letter Circular LC-739. Mimeographed.

Cooking Dehydrated Foods. War Department. Technical Manual TM 10-406. Price 15 cents.

Oleomargarine. Hearings on H. R. 2400. 78th Congress, 1st Session. House Committee on Agriculture. Price 55 cents.

Claims for Damage or Personal Injury, Incident to Noncombat Activities of the War Department or Army. War Department. Army Regulations No. 25-25. Price 5 cents.

Federal Specifications. New or revised specifications which make up Federal Standard Stock Catalog on the following items: Paper Shipping Sacks, UU-S-48. Motor-Fuels, VV-M-567. Oil, Tung (China-Wood), Raw, JJJ-O-353. Oil, Peanut, Z-O-358. Asphalt, (for use in) Road and Pavement-Construction, SS-A-706b. Leather, packing, chrome-vegetable-retanned, KK-L-231. Varnish; spar, water-resisting, TT-V-121b. Price 5 cents each.



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SHAVE-OFF LARGE DIAMETERS EXTRA-THICK METAL LARGE OUTLETS INNER WELDS GROUND SMOOTH CORRECTLY DESIGNED HOPPERS SPLIT-DUCT MANIFOLDS	HIGH COLLECTION EFFICIENCY LESS FAN BLADE WEAR LOW DRAFT LOSS LOW POWER CONSUMPTION HIGH TEMPERATURE RESISTANCE UNLIMITED CAPACITY NO MOVING PARTS FREE DUST FLOW	GREATER RECOVERY LOW MAINTENANCE LOW OPERATING COST LONG LIFE NO CLOGGING

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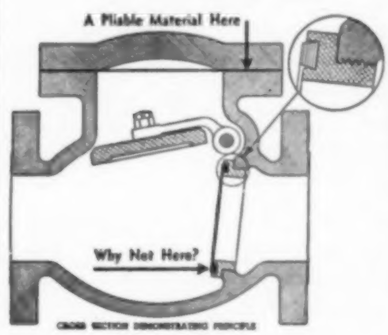

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MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterhead.

Protective Coatings. Hercules Powder Co., Wilmington, Del. 14-page technical booklet describing the use of the company's Lewisol Maleates in protective coatings.

Safety Glasses. American Optical Co., Southbridge, Mass.—A 16-page booklet entitled "Right on the Nose" explains in detail, quick, easy methods of adjusting non-prescription industrial safety goggles for worker's comfort.

Plastics. The Richardson Co., Melrose Park, Ill.—22-page illustrated booklet describing the industrial and consumer applications for plastics. A description of the company's custom service for molded and laminated plastics is included.

Packaging Machinery. Triangle Package Machinery Co., 906-920 North Spaulding Ave., Chicago 51, Ill.—20 page illustrated bulletin describing weighing, filling, measuring and carton-sealing equipment. Details on production rates of the packaging machines, methods of handling goods, and other data included.

Carbon Seal Rings. Pure Carbon Co., Inc., Saint Marys, Pa.—8-page illustrated folder dealing with carbon seal rings and their application to the bellows type shaft seals. Includes similar information on steam turbine seals, air seals, seal noses and others.

Fire Clay Brick. McLoed & Henry Co., Inc., Troy, N. Y.—4-page bulletin to introduce three fire clay brick products, Hyex, Super-Hyex, and Superam. Contains information regarding available sizes and specific applications.

Heat Treatment of Steel. Leeds & Northrup Co., 4934 Stenton Ave., Philda. 44, Pa.—6-page catalog entitled "Vapocarb-Hump Method for Heat-Treatment of Steel". A revised edition of 1940 catalog. Should be of interest to heat-treating departments and production executives of war plants.

Synthetic Rubber Glossary. Hycar Chemical Co., 335 S. Main St., Akron, Ohio—8-page pamphlet to meet demands for a glossary giving pronunciations and meanings of synthetic rubber words. Not a highly scientific treatise, it is designed to help business, industrial, and sales executives in discussion of this subject, and, thus, includes only the more common chemical terms and well-established trade names.

Flow-Meters. Cochrane Corp., 17th & Allegheny Ave., Philadelphia 32, Pa.—16-page reprint of "Flow Meter Engineering" telling why, when and where flow meters and instruments are needed in the modern plant, and how they can be made to further the war effort.

Pouring Buckets. The B. F. Goodrich Co., Akron, Ohio.—4-page catalog section (9425) on Flexite rubber pouring buckets, for the safe and economical handling of acids, corrosives, and liquid high explosives. This section also describes Flexite rubber dippers, hand rubber funnels, and anode acid rubber gloves.

Hydraulic Elevators. Revolvator Co., North Bergen, N. J.—4-page bulletin (96-J) illustrating and describing the company's line of hydraulic freight elevators. The folder includes illustrations of interesting installations, and a diagram for obtaining a particular installation quotation.

Tubing Identification. Formed Steel Tube Institute, 1621 Euclid Ave., Cleveland, Ohio.—A chart showing the symbols of all companies who manufacture welded steel tubing for heat transfer apparatus and who are reported to

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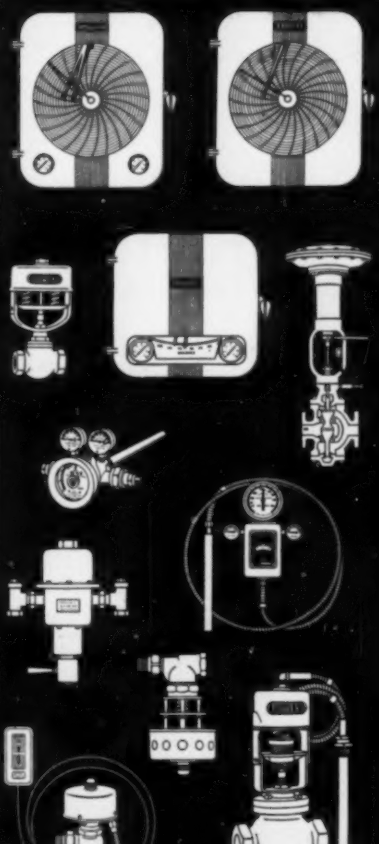

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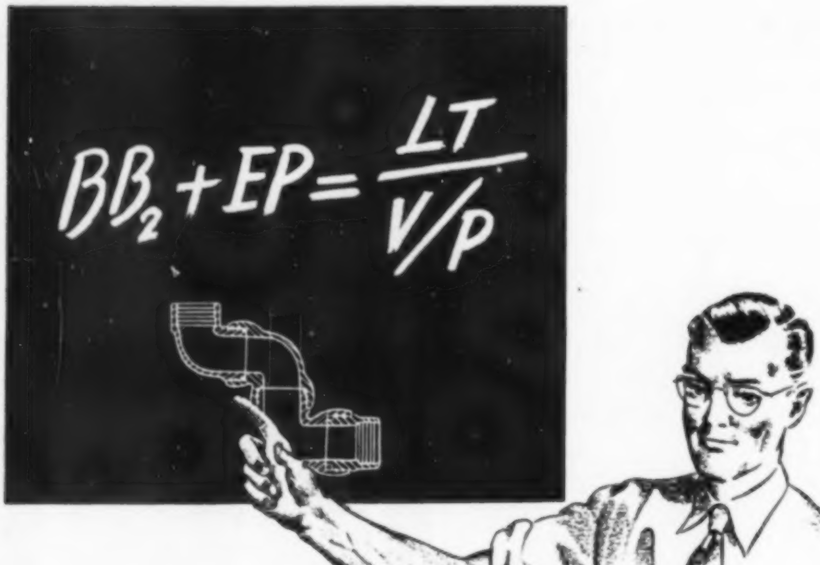

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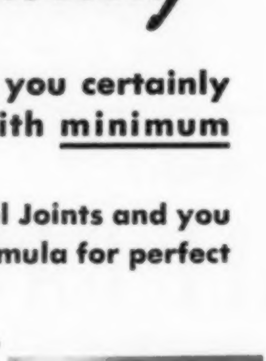

CHIKSAN Ball-Bearing Swivel Joints are supplied in over 500 different Types, Styles and Sizes. Manufactured in steel, malleable iron, bronze and aluminum. Sizes from ⅜" to 12"; larger sizes to order for pressures to 300 lbs. and to 3,000 lbs. at 225° F. and for pressures to 500 lbs. at 700° F. End connections optional. Write for latest Chiksan Catalog and Engineering Data.

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have adopted the method of symbol identification on each length of welded tubing.

Refrigeration. Air Conditioning and Refrigeration Machinery Assoc., Inc., Southern Bldg., Washington 5, D. C.—32-page booklet entitled "Refrigeration and Air Conditioning in War . . . in Peace" recording briefly the vital services performed by refrigeration and air conditioning in World War II . . . their essentiality to the morale and health of civilians and fighting men . . . and their use in the advancement of new industrial, nutritional and research techniques.

Radiant Heat. Westinghouse Lamp Div., Westinghouse Electric and Mfg. Co., Bloomfield, N. J.—12-page illustrated booklet telling what radiant heat is, and discussing its advantages. Takes up the design and performance of the drying lamp, design of radiant heat installations, the arrangement of equipment, and electrical circuit design. Booklet A-3817.

Materials Handling Machinery. The Yale & Towne Mfg. Co., Philadelphia 24, Pa.—124-page illustrated book entitled "Modern Materials Handling Machinery Applied to American Industry". Describes the handling of goods from time of receipt, through production, processing, storage and shipping.

Rubber Machinery. National Erie Corp., Erie, Pa.—32-page booklet describing with illustrations the company's machinery and equipment for processing rubber and plastics.

Sheaves. Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.—4-page illustrated bulletin on the Magic-Grip sheave. Six photographs demonstrate the put on-take off operation.

Manganese Steel. Amsco, American Manganese Steel Div., Chicago Heights, Ill.—30-page pamphlet on manganese steel for the clay products industry. Describes its application for excavating, hauling, crushing, mixing, and manufacturing equipment. Bulletin 1243-CP.

Pulverizer. The Babcock & Wilcox Co., 85 Liberty St., New York, N. Y.—4-page bulletin (G30-A) describing the company's Type E ball bearing pulverizer.

Machining of Steel. Haynes Stellite Co., Kokomo, Ind.—8-page illustrated booklet entitled "Operating Information on Stellite 98M2 Cobalt-Chromium-Tungsten Turning and Boring Tools and Milling Cutters". Intended to help users obtain the best results with this cast cobalt-base alloy which was developed for faster machining of steel. Form 5350.

Handling Equipment. Rose Mfg. Co., 12400 Strathmoor, Detroit, Mich.—6-page edition (second section) of an industrial Handling Equipment catalog providing a comprehensive file on factory trucks and trailors.

Recharging Extinguishers. C-O-Two Fire Equipment Co., U. S. Highway No. 1, Newark, N. J.—A pocket size booklet entitled "Recharging Instructions for Carbon Dioxide Extinguishers". Illustrated with drawings of the equipment required for and the procedure followed in recharging both system cylinders and portable extinguishers made by the company.

Chemical Catalog. Glyco Products Co., Inc., 26 Court St., Brooklyn 2, N. Y.—144-page catalog entitled "Chemicals by Glyco". Additions include a number of plasticizers for synthetic rubber, synthetic resins, etc., and further information on the esters manufactured by the company. Usual features have been retained, including formulas, suggestions and tables of useful chemical and physical data.

Ball Bearings. New Departure Division of General Motors, Bristol, Conn.—1944 edition of "Interchangeable Ball Bearings for Replacement", a booklet containing numerically arranged lists of ten competitive makes of ball bearings together with corresponding New Departure numbers, as well as a section explaining prefixes and suffices used with each make of bearing, and one on comparative bearing type and series numbering systems.

Paint Ordering Catalog. American-Marietta Co., 43 E. Ohio St., Chicago 11, Ill.—A fully illustrated catalog providing application suggestions, product descriptions, and technical data concerning heavy duty industrial maintenance paints of the Valdura line.

Pipe and Tube Bending. Copper & Brass Research Assoc., 420 Lexington Ave., New York 17, N. Y.—80-page treatise showing methods and devices for bending pipes and tubes of copper and its alloys. Contains 112 figures and illustrations, as well as pertinent information on the chemical and physical properties of such pipe material.

Metallizing Process. Metallizing Co. of America, 1330 W. Congress St., Chicago, Ill.—40-page catalog dealing with all phases of the

metalizing process in which all information is classified according to industry. A section is devoted to the history, development, use and technique of metalizing. The equipment section deals with the Mongul Electric Bonder, Mogul Link, etc. Another section gives questions and answers pertaining to metallizing.

Vibration Study. The Cooper-Bessemer Corp., 2511 Terminal Tower, Cleveland, Ohio. —8-page reprint of a techical paper entitled "The Vibration Characteristics of 'Free-Free' Circularly Curved Bars" reporting the outcome of an extensive study, the results of which furnish data that make it possible to calculate with reasonable accuracy, the frequency of vibration, parallel or transverse, of any incomplete, free-free, circularly curved bar of uniform cross section where its mechanical constants are known. Illustrated.

Electronic Tubes. Electronics Dept., General Electric Co., Schenectady, N. Y.—4-page bulletin (ET-12) containing a quick-selection chart of electronic tubes for industry.

Gyratory Sifter. Allis-Chalmers Mfg. Co., Milwaukee 1, Wisconsin.—16-page bulletin (B-6124A) including perspective drawings of low-head sifter sieves, showing what takes place in a sifter box. What the sifter user should know of the material is listed in 10 points. Specification tables, illustrations, and questions and answers are also given.

Silent Chain Drives. Morse Chain Co., Ithaca, N. Y.—80-page illustrated bulletin includes, in addition to the usual specifications and price lists, new material covering the advances and developments made in the high-speed chain drives and other fields. Bulletin 43.

Water Softener. Cochrane Corp., 17th & Allegheny Ave., Philadelphia 32, Pa.—8-page illustrated reprint of "Improvements in the Hot Process Water Softener" covering a brief history of the development of this method of feed water conditioning. Chemical reagents and new improvements are discussed.

Powdered Metal Parts. Keystone Carbon Co., Inc., Saint Marys, Pa.—32-page booklet "Powder Metallurgy" covering the advantages and latest applications of powdered metal parts. Designers aid section and table on engineering properties are included. Second section of the booklet is devoted to Selflube porous bronze bearings, Selflube porous iron bearings and D-10 graphite impregnated brass bearings.

Coal Tar Chemicals. Reilly Tar & Chemical Corp., Merchants Bank Bldg., Indianapolis, Ind.—56-page booklet describing the various coal tar products of this company. This second edition includes new by-products of coal tar recently made available.

Wire Cloth. C. O. Jelliff Mfg. Corp., Southport, Conn.—96-page technical reference book listing data and price lists for Jelliff industrial wire cloth.

Band Filing. Continental Machines Inc., 1301 Washington Ave. South, Minneapolis, Minn.—4-page bulletin on the DoALL Band Filing machine including information on file broaching operations on metals, wood and plastics.

Acid Addition Agent. The Enthone Co., Dept., CME, 442 Elm St., New Haven, Conn. —4-page bulletin describing the company's product "Acid Addition Agent", its advantages and applications.

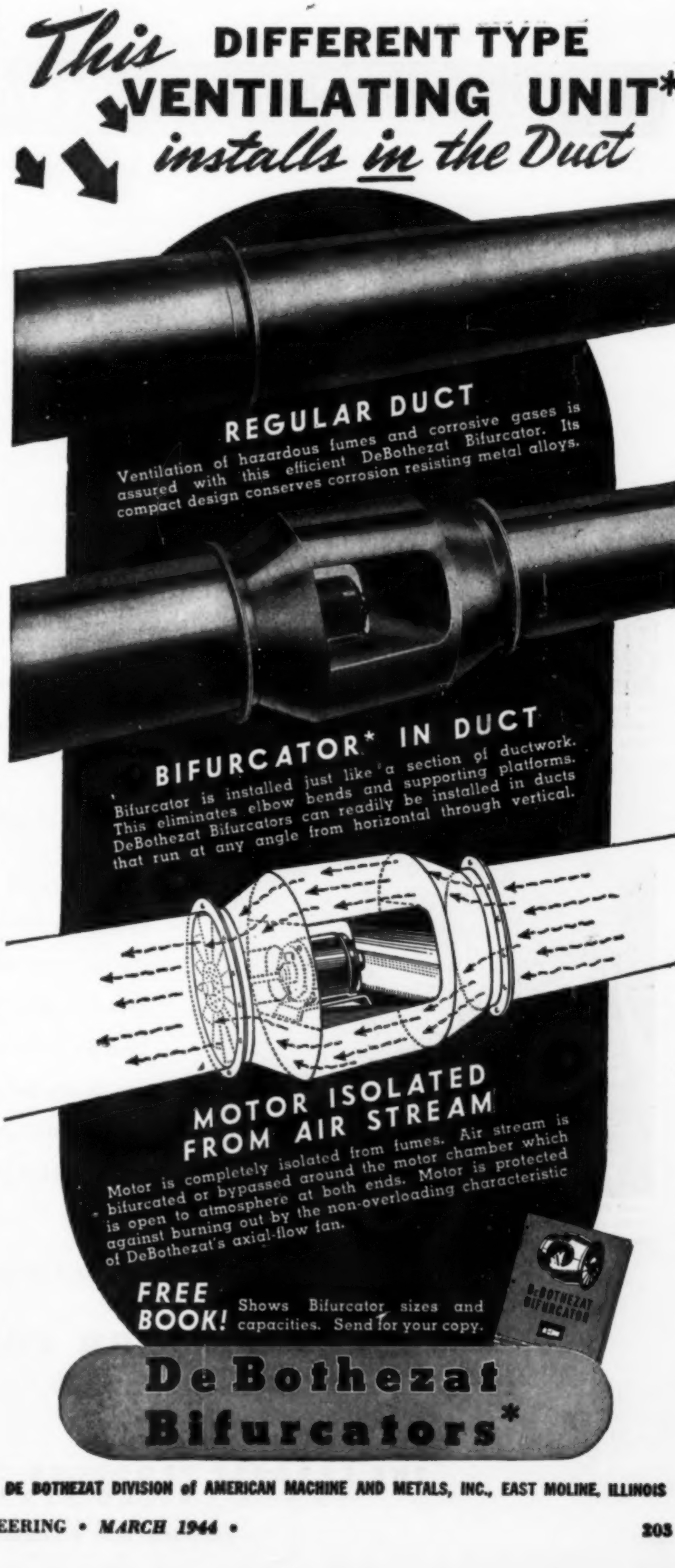
Emulsion Waxes. The Enthone Co., Dept. CME, 442 Elm St., New Haven, Conn.—4-page bulletin describing hard drying rust-inhibiting waxes available to the metal treating industry.

Motorized Valves. Automatic Temperature Control Co., Inc., 34 East Logan St., Philadelphia 44, Pa.—4-page illustrated bulletin A3 including detailed engineering and application data concerning high-speed motorized valves for "On-Off" control of steam, air, oil, gas or chemical solutions.

Stuffing-Box Problems. Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.—8-page illustrated bulletin describing the Shaft-Seal which is intended for services in which unusual stuffing-box conditions are encountered. Bulletin 7018 describes advantages, construction, installation and operation of the Shaft-Seal.

Leaf Filter. Niagara Filter Corp., 1432 Niagara St., Buffalo, N. Y.—16-page booklet to acquaint food and chemical processing technicians with the features of the Niagara filters, their construction, uses and advantages. Illustrated.

Pressure Guage. Manning, Maxwell & Moore, Inc., Bridgeport 2, Conn.—12 page illustrated bulletin on the phenol turret case Duraguage.



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Lead pipe systems, as above, are extensively used in flumes where acid is carried through welded lead pipe for great distances.

Studying the properties of lead, one is immediately impressed with its ability to resist corrosion. We have seen lead pipe in excellent condition, that was put in service in Rome over 1800 years ago.

Plumbers are continually digging up lead pipe that has lain in muck and mud and damp earth for fifty years or more, that is still in perfect condition.

Some of the most famous buildings in England have lead gutters and leaders which have been used for centuries. The use of lead as a roofing material has enabled many historic edifices to withstand the ravages of time and the elements.

Old cast lead monuments seem to last forever.

Lead's resistance to the corrosive action of chemicals is known throughout the industry. Great quantities of sheet lead and lead pipe are used in the construction and operation of chemical and industrial plants. Steel has been protected by a tin-lead alloy called Terne metal, and during the present tin shortage, by lead with extremely small quantities of tin. Lead paints get their lasting quality from the durability of the metal.

If you want it to last, make it of lead.

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CHEMICAL ECONOMICS

H. M. BATTERS, Market Editor

PRODUCTION OF CHEMICALS HAS SHOWN PROGRESSIVE DECLINE IN LAST THREE MONTHS

As a result of cutbacks in the military program and the closing of some ordnance plants, the output of chemical products has been at a declining rate since last October. The unadjusted index of the Federal Reserve Board stood at 401 in October, dropped to 392 in November, 367 in December, and the preliminary figure for January is 358. In this compilation the Board uses the term chemicals in an inclusive sense with paints, soap, rayon, industrial chemicals, and explosives and ammunition as the components. While all these branches have contributed somewhat to the declining trend, it is fair to assume that the major influence came from curtailment in outputs of explosives and ammunition. As the current output of ammunition is reported to be sufficient for requirements and for holding stocks at the desired level it is probable that peak production of chemicals has been passed.

A separate index for industrial chemicals is prepared by the Federal Reserve Board. This is confined to the "chemicals not elsewhere classified" as reported by the Bureau of the Census and charts the monthly progress of chemicals without the inclusion of allied products. This index advanced from 396 in October to 398 in November but declined to 394 in December and the preliminary figure for January is 392. While many of these chemicals tie in closely with the war program and hence would be affected by cutbacks, they also get the benefit of the newer developments, such as manufacture of synthetic rubber, and if requirements for civilian goods hold up, it is probable that total needs will force production schedules to heights not yet attained. Hence in following the monthly progress of chemicals, a distinction must be drawn between an index which includes many related products and one which is chemical in a literal sense.

In addition to steadily rising outputs of such products as butadiene and styrene, the outlook for enlarged production of chemicals is brightened by plans for increasing supplies of alcohol, sulphuric acid, and phthalic anhydride. Requirements for alcohol were revised upwards in March and ways are being sought to bring production and demand in balance. Productive capacity of sulphuric acid plants, not including ordnance acid, is expected to exceed 14,900,000 tons in terms of 50 deg. acid by the latter part of this year but some of the new capacity will not come into operation until late in the year. The scarcity of phthalic anhydride has more recently forced recognition and plans are being studied either to add to existing plants or to increase the number of plants. Essential requirements for plastics, which use phthalic anhydride in their manufacture, are not being met and some action is necessary to relieve this condition.

The *Chem. & Met.* index for industrial consumption of chemicals stands at 179.28 for January compared with a revised figure of 176.96 for December. The number for January, 1943 was 173.20. Comparison with earlier months indicates that all consuming industries are not moving in unison as some of them have increased their raw material requirements while others have reduced their rates of operation. The situation promises to remain mixed for some time to come but the rates of increase in heavily weighted industries point to a moderate uplift in the composite index number.

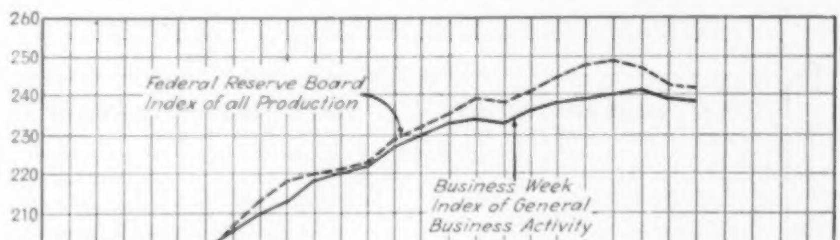
Data for production, consumption at producing plants and stocks, which are now issued monthly for specified chemicals by the Chemicals Bureau of WPB, comprise a fair cross-section of the industry and the figures are valuable inasmuch as they are authoritative. The production data for December show that most of the tonnage chemicals gained over the totals reported for the preceding month. Gains over November are noted in the case of such important chemicals as sulphuric acid, soda ash, caustic soda, chlorine, acetylene, anhydrous ammonia, bleaching powder, and sodium silicate. Bichromate of soda, however, which reached a record production of 7,450 tons in November dropped to 6,688 tons in December and manufacturers are finding it difficult to secure competent workers.

Chem. & Met. Index for Industrial Consumption of Chemicals
1935 = 100

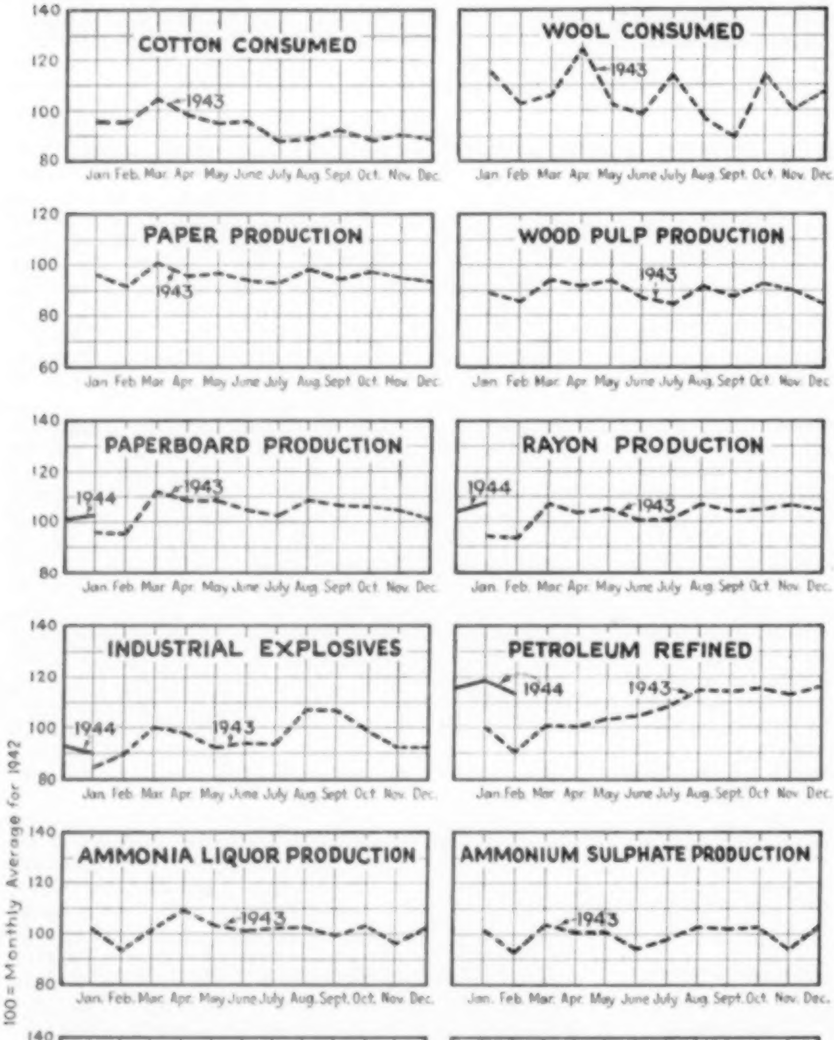
	Dec. revised	Jan.
Fertilizer	42.52	42.50
Pulp and paper	17.95	19.40
Petroleum refining	17.24	17.38
Glass	18.50	18.75
Paint and varnish	13.25	14.00
Iron and steel	13.67	13.75
Rayon	16.12	16.41
Textiles	11.00	10.70
Coal products	9.85	9.90
Leather	4.30	4.25
Industrial explosives	5.35	5.19
Rubber	3.00	3.00
Plastics	5.30	5.40
	178.45	180.63

The status of industries which make use of fats and oils as raw materials may be inferred from the allocations of these materials. For edible use, it is estimated that per capita consumption of fats and oils in 1944 will be 43.9 lb. as against 46.5 lb. in 1943. For inedible use, the allocations refer only to the first quarter of the year and are as follows; the figures referring to millions of pounds: soap, 518.2; paint and varnish, 124.3; coated fabrics, 25.2; printing ink, 6.4; lubricating oils, 70.7; textiles and leather, 44.8; rubber, 39.8; core oils, 21.7; vitamin carriers, 7.5; pharmaceutical, 5.7; putty and other caulking compounds, 8.3; other industrial uses, 73.5.

While the output of plate glass may move up this year, the outlook for the glass industry as a whole seems to be much in line with what it was last year. The use of white arsenic will be lowered as the industry has been allocated 3,000 tons for the year as compared with a consumption of 5,000 tons in 1941. The container branch has been informed that the supply of soda ash will be adequate provided the rate of consumption does not exceed that for 1943. However, possible shortages of newsboard, pulpboard and kraft for closure liners may have an adverse effect on production of glass containers as about 70 percent of ths year's estimated production will require paper liners.



PRODUCTION AND CONSUMPTION TRENDS



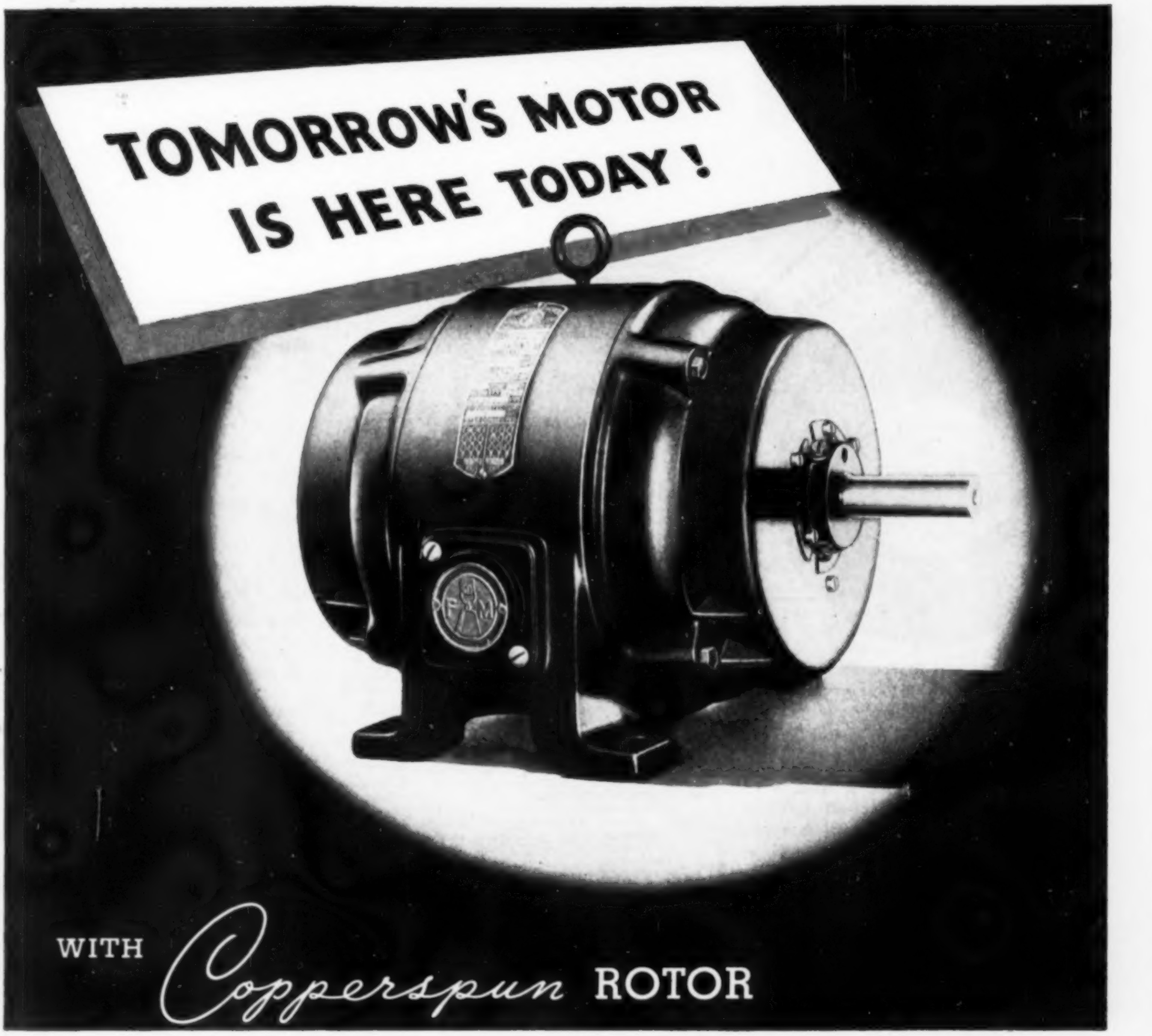
As the year advances, the position of some of the chemical-consuming industries becomes clearer. Among the outlets which give promise of an expanded demand for raw materials is the rubber industry. While some improvement may be found in the volume of imports of natural product, the emphasis is placed on production of synthetic. Production of synthetic rubber in January was reported as about 50,000 long tons. In addition about 35,000 tons of scrap is being reclaimed each month. With larger outputs of synthetic in prospect as the program progresses toward completion, it is evident that the over-all supply will show a gain over that for last year, even though this may help civilian consumers but little.

Reports about activities at petroleum refineries also are encouraging for the year to date. Daily runs to stills in January were close to record highs and an even higher rate was maintained throughout February. Incidentally an encouraging outlook for the industry in postwar years was presented last month by a representative of one of the largest producing companies. He forecast that by 1949, demand for petroleum would hit an average of 5,000,000 bbl. a day which would be about 600,000 bbl. per day over the current rate. He further stated that this total would be reached despite a gradual decline in export shipments. This increase, however, was to be preceded by a temporary drop of not more than 15 percent from current rates.

Textile mills are confronted with a situation where they will be called upon to fill military needs in about the same volume as last year which combined with regular demands would mean full operation of plants. The industry did not get off to a very good start as labor troubles slowed production at some mills in New England. There was a drop in total consumption of cotton in January with southern mills down 8.5 percent from January 1943, while New England mills were down 26.6 percent. The outlook for textile production is clouded by difficulty in securing needed new equipment and by the steady drain on skilled manpower. Scarcity of certain dyestuffs also is a handicap in dyeing and printing branches.

Production in lines which use animal glues are affected by the supply of which grows worse instead of better. Actions taken late in January to relieve the tight situation that had been growing have not been able to relieve the shortage of labor or the shortage of raw materials, the basic troubles. Since the orders controlling the distribution and uses of animal glue were written, production has not been sufficient to meet allocations. Under these circumstances a downward revision of the amounts permitted for various end uses may be expected unless there is an immediate marked improvement in available supplies.

The raw material supply is not expected to improve for some months. The drag between the time cattle are killed in the packing plants and the time the hide trimmings and fleshings reach the glue factory amounts to three months or more.



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Original
FRANCE
METAL PACKING

U. S. Production, Consumption and Stocks Synthetic Organic Chemicals*

Item	1941[1]	1942	1943
Acetanilide (tech. and U. S. P.):			
Production	2,937,318	7,651,883	13,822,780
Consumption	...	2,571,147	4,574,346
Stocks	...	186,114	669,479
Acetic acid (synthetic):[2]			
Production	225,671,063	264,898,632	293,801,107
Consumption	...	197,424,778	196,592,316
Stocks	...	11,637,350	7,419,886
Acetic anhydride:[3]			
Production	[4]	430,363,880	460,237,021
Consumption	...	336,162,204	353,589,213
Stocks	...	10,463,495	11,408,754
Acetyl salicylic acid:			
Production	8,084,003	8,650,113	8,577,173
Consumption	...	[4]	[4]
Stocks	...	914,185	780,955
n-Butyl acetate:			
Production	93,226,698	67,024,658	64,156,844
Consumption	...	[4]	[4]
Stocks	...	2,110,814	2,228,084
Creosote oil (gallons):			
Production	103,170,750	133,076,971	120,650,601
Consumption	...	12,749,897	12,463,384
Stocks	...	8,995,673	16,743,032
Creosols, meta-para:			
Production	[4]	7,041,626	8,861,250
Consumption	...	1,279,021	1,296,620
Stocks	...	231,068	192,784
Cresols, ortho-meta-para:[4]			
Production	17,045,033	10,846,891	8,360,944
Consumption	...	[4]	[4]
Stocks	...	[4]	[4]
Cresylic acid, crude:			
Production	[4]	20,389,956	25,245,555
Consumption	...	[4]	[4]
Stocks	...	[4]	1,008,748
Cresylic acid, refined:			
Production	26,595,853	36,113,811	39,109,301
Consumption	...	3,629,963	6,273,444
Stocks	...	[4]	2,115,270
Diethyl ether (all grades):			
Production	22,645,521	55,017,609	64,069,517
Consumption	...	[4]	[4]
Stocks	...	1,956,371	2,205,527
Ethyl acetate (85%):			
Production	94,689,878	86,542,085	102,472,494
Consumption	...	12,615,727	17,297,565
Stocks	...	6,671,365	3,432,681
Lactic acid (edible):			
Production	2,334,058	3,124,439	4,456,284
Consumption	...	[4]	[4]
Stocks	...	269,159	327,405
Lactic acid (technical):			
Production	2,646,210	2,931,106	3,197,535
Consumption	...	142,655	112,995
Stocks	...	176,848	162,287
Methyl chloride (all grades):			
Production	4,911,360	[4]	13,026,129
Consumption	...	[4]	[4]
Stocks	...	1,441,644	1,012,127
Naphthalene, crude:[7]			
Production	113,732,224	155,313,085	194,409,745
Consumption	...	65,976,135	[4]
Stocks	...	6,527,542	8,149,226
Naphthalene, refined:[8]			
Production	70,801,554	81,583,820	83,551,952
Consumption	...	38,541,162	46,486,796
Stocks	...	4,939,056	3,487,313
Niacinamide:			
Production	21,111	70,257	160,067
Consumption	...	[4]	[4]
Stocks	...	10,184	37,382
Oxalic acid (technical):			
Production	15,851,200	15,110,276	17,101,588
Consumption	...	[4]	[4]
Stocks	...	307,956	680,250
Phenobarbital and sodium salts:			
Production	281,108	340,388	318,127
Consumption	...	42,033	41,764
Stocks	...	74,936	64,218
Phthalic anhydride:			
Production	[4]	94,807,180	113,067,286
Consumption	...	44,504,625	33,847,955
Stocks	...	3,922,218	1,642,082
Riboflavin (for human use):			
Production	2,777	16,381	75,640
Consumption	...	[4]	[4]
Stocks	...	3,167	23,179
Sulfa drugs (total):			
Production		5,434,427	9,860,330
Consumption	...	1,091,515	2,260,346
Stocks	...	259,513	1,350,241

*All data in pounds except as noted. Production includes material produced whether consumed in producing plants or sold; consumption represents consumption at producing plants only and includes material produced in such plants, or material purchased or transferred from other plants; stocks are company stocks, as of the last day of the year, located at plant, in transit, or in warehouse, and include purchased as well as produced material. [1] Data obtained from United States Tariff Commission Preliminary Annual Report on U. S. Production and Sales of Synthetic Organic Chemicals, 1941. [2] Production of natural acetic acid (direct process from wood) according to the Bureau of the Census was as follows: 1941, 42,306,768 lb.; 1942, 42,724,323 lb.; 1943, 35,740,372 lb.; and production from calcium acetate was as follows: 1941, 11,251,700 lb.; 1942, 7,505,224 lb.; and 1943, 12,138,164 lb. Production of recovered acetic acid is confidential. [3] Includes acetic anhydride produced from acetic acid by the vapor phase process. [4] Confidential because publication would reveal operations of individual companies. [5] Includes data obtained from distillers of purchased coal tar only. Total production, including that reported to the Bureau of Mines by byproduct coke-oven operators, amounted to 143,502,000 gal. in 1941; to 166,285,000 gal. in 1942, and to 167,928,581 gal. in 1943. [6] Includes statistics reported to the Bureau of Mines by byproduct coke-oven operators and compiled by the Coal Economics Division, Bureau of Mines. [7] Less than 79 deg. C. Includes the grade solidifying at less than 74 deg. C. produced for sale only. Other grades included are the grade solidifying between 74 deg. C. and 76 deg. C. and the grade solidifying at more than 76 deg. C. but less than 79 deg. C. The data therefore represent some duplication. [8] 79 deg. C. and over.

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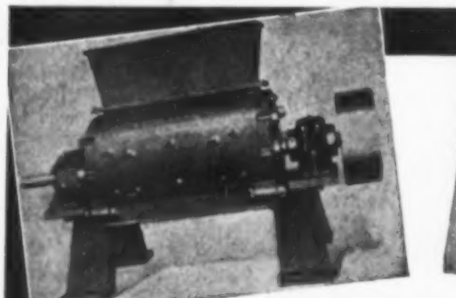
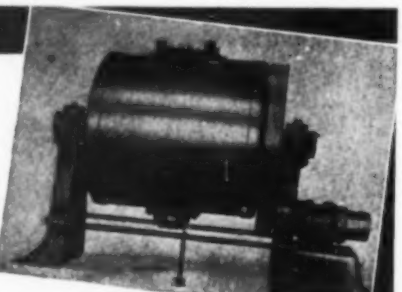
United States Production, Consumption and Stocks of Chemicals: December 1943

December statistics on the chemicals shown in this table supplement the 1941-1943 figures. (See *Chem. & Met.* Feb. 1944, pp. 129-134.)

Chemical and Basis	Units*	December 1943 Production	December 1943 Made and Consumed	December 1943 Stocks	November 1943 Production	November 1943 Made and Consumed	November 1943 Stocks
Acetylene: For use in chemical synthesis	M cu.ft.	324,253	80,820	[1]	[2] 309,026	81,082	[1]
For commercial purposes	M cu.ft.	[2] 149,224			[2] 150,672		
Synthetic anhydrous ammonia (100% NH_3)	Tons	48,657	[2] 39,663	6,580	46,318	38,301	4,911
Bleaching powder (35%–37% avail. Cl_2)	M lb.	5,591	1,459	651	[2] 5,134	[2] 1,754	[2] 692
Calcium acetate (80% Ca $(C_2H_3O_2)_2$)	M lb.	1,356	[3]	342	1,416	[3]	413
Calcium arsenate (100% $Ca_3(AsO_4)_2$)	M lb.	5,855	50	9,413	1,518	72	8,349
Calcium carbide (100% CaC_2)	Tons	55,985	[4]	[2] 11,786	52,457	[4]	11,571
Calcium hypochlorite (true) (70% available Cl_2)	M lb.	971	[3]	979	985	[3]	950
Calcium phosphate — monobasic (100% $CaH_4(PO_4)_2$)	M lb.	5,147	[3]	4,361	5,872	[3]	4,784
Carbon dioxide: Liquid and gas (100% CO_2)	M lb.	26,444	2,627	4,829	23,819	2,253	1,858
Solid (dry ice) (100% CO_2)	M lb.	39,237	2,026	2,501	40,150	779	3,514
Chlorine	Tons	[2] 111,584	[2] 60,664	[2] 8,242	106,420	[2] 60,545	[2] 6,398
Chrome green (C.P.)	M lb.	627	65	[2] 788	665	35	840
Hydrochloric acid (100% HCl)	Tons	30,912	17,532	[2] 2,902	[2] 29,690	17,323	2,395
Hydrogen	Millions of cu.ft.	[2] 1,771	1,449	[4]	1,680	1,372	[4]
Lead arsenate (acid and basic)	M lb.	6,970	22	8,039	7,572	73	8,464
Lead oxide — red (100% Pb_3O_4)	M lb.	9,406	495	4,944	8,192	[2] 723	4,723
Methanol: Natural (80% CH_3OH)	Gal.	379,498	[4]	244,261	366,620	[4]	261,344
Synthetic (100% CH_3OH)	M gal.	5,069	[3]	4,723	5,210	[3]	5,143
Molybdate orange (C.P.)	Lb.	96,148	3,361	106,624	131,474	3,070	119,549
Nitric acid (100% HNO_3)	Tons	39,571	36,511	7,563	42,404	37,917	8,556
Oxygen	M cu.ft	[2] 1,443,379	34,828	[1]	1,460,271	37,180	[1]
Phosphoric acid (50% H_3PO_4)	Tons	[2] 53,705	[2] 47,548	[2] 12,043	52,790	51,107	12,551
Potassium bichromate and chromate (100%)	M lb.	647	[3]	656	[2] 708	[3]	[2] 733
Potassium chloride (100% KCl)	Tons	99,588	[3]	17,867	91,974	[3]	41,414
Potassium hydroxide (caustic potash) (100% KOH)	Tons	3,533	811	2,079	3,619	809	2,242
Soda ash — Ammonia soda process:							
Total wet and dry [5] (98%–100% Na_2CO_3)	Tons	[2] 392,633	......	......	379,015	......	......
Finished light (98%–100% Na_2CO_3)	Tons	[6] 205,637	[2] 35,910	[2] 18,471	[6] 207,553	39,490	16,288
Finished dense (98%–100% Na_2CO_3)	Tons	124,515	3,116	[2] 6,826	110,902	2,682	8,172
Natural	Tons	13,763	129	1,911	15,337	......	2,205
Sodium bicarbonate (refined) (100% $NaHCO_3$)	Tons	14,192	[3]	4,933	15,185	[3]	4,862
Sodium bichromate and chromate (100%)	Tons	6,688	[3]	543	7,450	[3]	894
Sodium hydroxide, liquid: Electrolytic process (100% NaOH)	Tons	[2] 105,482	[2] 25,517	[2] 37,416	97,588	21,042	33,645
Lime-soda process (100% NaOH)	Tons	[2] 56,037	[3]	[2] 13,730	56,871	[3]	12,878
Sodium phosphate: Monobasic (100% NaH_2PO_4)	M lb.	2,096	[3]	328	2,062	[3]	541
Dibasic (100% Na_2HPO_4)	Tons	3,946	[3]	971	3,744	[3]	645
Tribasic (100% Na_3PO_4)	Tons	6,463	96	1,665	6,599	156	1,325
Sodium silicate (water glass): Liquid (40° Baumé)	Tons	92,736	[4]	113,052	90,584	[4]	[2] 106,089
Solid (all forms combined)	Tons	10,158	2,955	10,437	9,854	2,368	11,041
Sodium sulphate: Glauber salt and crude salt cake [7]	Tons	68,162	6,806	72,627	69,196	6,684	62,820
Anhydrous (refined) (100% Na_2SO_4)	Tons	5,792	[3]	6,524	5,402	[3]	5,435
Sulphur dioxide (100% SO_2)	M lb.	6,754	2,943	2,620	7,410	2,799	5,175
Sulphuric acid:[7] Chamber process (100% H_2SO_4)	Tons	[2] 294,067	......	[2] 244,301	297,215	......	190,942
Contact process [8] (100% H_2SO_4)	Tons	[2] 523,671	......		493,864	......	
Net contact process [9] (100% H_2SO_4)	Tons	[2] 459,856	......	......	423,314	......	......
White lead	Tons	7,231	2,048	8,047	[2] 6,307	1,563	[2] 6,993
Zinc yellow (C.P.)	M lb.	2,229	[2] 206	867	2,428	198	811

* All tons are 2,000 lb. [1] Not yet available. [2] Revised. [3] Data cannot be published. [4] Not available. [5] Total wet and dry production. [6] Not including quantities converted to finished dense soda ash. [7] Data collected in cooperation with Bureau of Mines. [8] Includes oleum grades. [9] Excludes spent acid.

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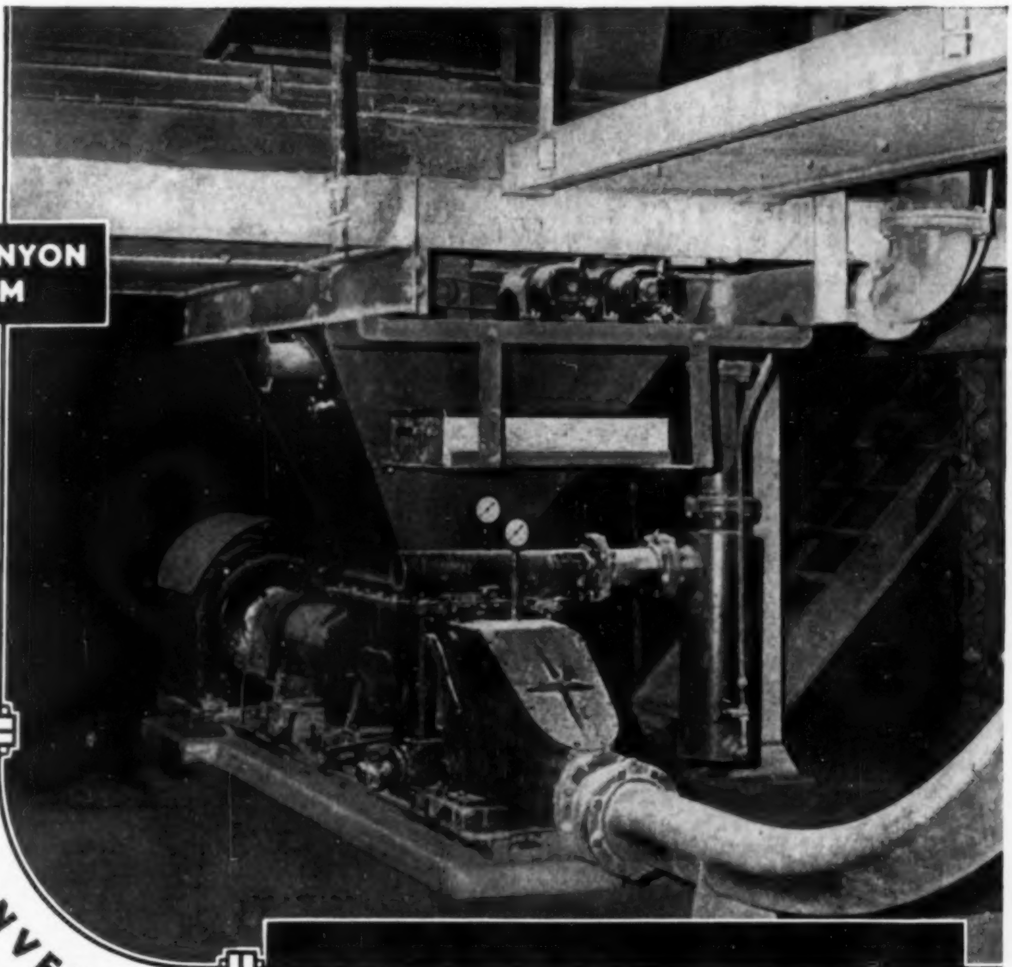

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- Bag fume
- Baroid
- Barytes
- Catalyst
- Cement (Portland)
- Cement raw materials
- Clays (dried)
- Colox
- Copper converter dust
- Dextrine
- Dolomite
- Fuller's earth
- Gypsum (raw)
- Lime (quick)
- Magnesite
- Manganese Dioxide
- Ore (pulverized)
- Rock dust
- Siliceous Powder
- Starch (Pearl)
- Starch (Powdered)

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SAFETY—Explosion proof . . . air for conveying insufficient to support combustion. No mechanical or dust hazards.

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ELIMINATES STRAIGHT-LINE CONVEYING—Cuts corners to shorten conveying distances . . . anywhere a pipe line can be placed: horizontally, vertically, up or down hill.

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P-47

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CHEM. & MET.

Weighted Index of Prices for

CHEMICALS

Base = 100 for 1937

This month	109.49
Last month	109.59
March, 1943	108.85
March, 1942	109.19

CURRENT PRICES

The accompanying prices refer to round lots. Where it is trade custom to sell fob works, quotations are so designated. Prices are corrected to March 13.

INDUSTRIAL CHEMICALS

Acetone, tanks, lb	$0.07 –	......
Acid, acetic, 28%, bbl., 100 lb.	3.38 –	$3.63
Boric, bbl., ton	109.00 –	113.00
Citric, kegs, lb	.20 –	.23
Formic, cbys, lb	.10½ –	.11
Hydrofluoric 30% drums, lb	.08 –	.08½
Lactic, 44%, tech., light, bbl., lb.	.073 –	.075
Muriatic, 18°, tanks 100 lb.	1.05 –	......
Nitric, 36°, carboys, lb.	.05 –	.05½
Oleum, tanks, wks., ton	18.50 –	20.00
Oxalic, crystals, bbl., lb	.11¼ –	.12½
Phosphoric, tech., tanks, lb.	.04 –	......
Sulphuric, 60°, tanks, ton	13.00 –	......
Tartaric, powd., bbl., lb	.70½ –	......
Alcohol, amyl	–	......
From Pentane, tanks, lb	.131 –	......
Alcohol, butyl, tanks, lb.	.10¾ –	.18½
Alcohol, ethyl, denatured, 190 proof	–	......
No. 1 special, tanks, gal, wks.	.50 –	......
Alum, ammonia, lump, bbl., lb	.04½ –	......
Aluminum sulphate, com. bags, 100 lb	1.15 –	1.40
Aqua ammonia, 26°, drums, lb.	.02½ –	.03
tanks, lb.	.02 –	.02½
Ammonia, anhydrous, cyl., lb	.16 –	......
tanks, lb	.04½ –	......
Ammonium carbonate, powd. tech., casks, lb	.09½ –	.12
Sulphate, wks., ton	28.20 –	......
Amylacetate tech., from pentane, tanks, lb	.145 –	......
Arsenic, white, powd., bbl., lb	.04 –	.04½
Barium carbonate, bbl., ton	60.00 –	65.00
Chloride, bbl., ton	79.00 –	81.00
Nitrate, casks, lb	.11 –	.12
Blanc fix, dry, bags, ton	60.00 –	70.00
Bleaching power, f.o.b., wks., drums, 100 lb.	2.50 –	3.00
Borax, gran., bags, ton	45.00 –	......
Calcium acetate, bags	3.00 –	......
Arsenate, dr., lb	.07 –	.08
Carbide drums, ton	50.00	
Chloride, flake bags, del., ton	18.50 –	25.00
Carbon bisulphide, drums, lb.	.05 –	.05½
Tetrachloride drums, gal	.73 –	.80
Chlorine, liquid, tanks, wks., 100 lb	1.75 –	2.00
Copperas, bgs., f.o.b., wks., ton	17.00 –	18.00
Copper carbonate, bbl., lb	.19½ –	.20
Sulphate, bbl., 100 lb	5.00 –	5.50
Cream of tartar, bbl., lb	.57 –	......
Diethylene glycol, dr., lb	.14 –	.15½
Epsom salt, dom., tech., bbl., 100 lb.	1.90 –	2.00
Ethyl acetate, tanks, lb	.11½ –	......
Formaldehyde, 40%, bbl. lb	.05½ –	.06
Furfural, tanks, lb	.09 –	......
Glaubers salt, bags, 100 lb	1.05 –	1.10
Glycerine, c.p., drums, extra, lb	.18½ –	......
Lead:		
White, basic carbonate, dry casks, lb	.08½ –	......
Red, dry, sck., lb	.09½ –	......
Lead acetate, white crys., bbl., lb.	.12½ –	.13
Lead arsenate, powd., bag, lb	.11½ –	.12
Lithopone, bags, lb	.04½ –	.04½
Magnesium carb., tech., bags, lb.	.06½ –	.06½
Methanol, 95%, tanks, gal	.58 –	......
Synthetic, tanks, gal	.28 –	......
Phosphorus, yellow, cases, lb.	.23 –	.25
Potassium bichromate, casks, lb	.09½ –	.10
Chlorate, powd., lb	.09½ –	.12
Hydroxide (c'stic potash) dr., lb.	.07 –	.07½
Muriate, 60% bags, unit	.53½ –	......
Nitrate, bbl., lb	.05½ –	.06
Permanganate, drums, lb	.19½ –	.20
Prussiate, yellow, casks, lb.	.17 –	.18
Sal ammoniac, white, casks, lb	.0515 –	.06
Salsoda, bbl., 100 lb	1.00 –	1.05
Salt cake, bulk, ton	15.00 –	......
Soda ash, light, 58%, bags, contract, cwt	1.05 –	......
Dense, bags, cwt	1.15 –	......
Soda, caustic, 76%, solid, drums, cwt	2.30 –	3.00
Acetate, del., bbl., lb.	.05 –	.06
Bicarbonate, bbl., cwt	1.70 –	2.00
Bichromate, casks, lb	.07½ –	.09
Bisulphate, bulk, ton	16.00 –	17.00
Bisulphite, bl., lb	.03 –	.04

CHEM. & MET.

Weighted Index of Prices for

OILS & FATS

Base = 100 for 1937

This month	**145.24**
Last month	145.24
March, 1943	145.37
March, 1942	141.32

Chlorate, kegs, lb	.06½ -	.06¾
Cyanide, cases, dom., lb	.14½ -	.15
Fluoride, bbl., lb	.07 -	.08
Hyposulphite, bbl., cwt	2.40 -	2.50
Metasilicate, bbl., cwt	2.50 -	2.65
Nitrate, bulk, cwt	1.35 -	....
Nitrite, casks, lb	.06¾ -	.07
Phosphate, tribasic, bags, lb	2.70 -	....
Prussiate, yel. bags, lb	.09¾ -	.10
Silicate (40° dr.), wks., cwt	.80 -	.85
Sulphide, bbl., lb	.02¾ -	....
Sulphite, crys, bbl., lb	.02½ -	.02¾
Sulphur, crude at mine, long ton	16.00 -	....
Dioxide, cyl., lb	.07 -	.08
Tin crystals, bbl., lb	.39½ -	....
Zinc, chloride, gran, bbl., lb	.05¾ -	.06
Oxide, lead free, bag, lb	.07½ -	....
5% leaded, bags, lb	.07½ -	....
Sulphate, bbl., cwt	3.85 -	4.00

OILS AND FATS

Castor oil, No. 3 bbl., lb	$0.13¾ -	$0.14½
Chinawood oil, bbl., lb	.38 -	....
Coconut oil, Ceylon, tank, N. Y., lb	nom	....
Corn oil crude, tanks (f.o.b. mill), lb	.12¾	....
Cottonseed oil, crude (f.o.b. mill), tanks, lb	.12¾ -	....
Linseed oil, raw car lots, bbl., lb	.151 -	....
Palm casks, lb	.09 -	....
Peanut oil, crude, tanks (mill), lb	.13 -	....
Rapeseed oil, refined, bbl., lb	nom	....
Soya bean, tank, lb	.11¾ -	....
Menhaden, light pressed, dr., lb	.1305 -	....
Crude, tanks (f.o.b. factory) lb	.089 -	....
Grease, yellow, loose, lb	.08½ -	....
Oleo stearine, lb	.09¼ -	....
Oleo oil, No. 1	.11¼ -	....
Red oil, distilled, dp.p. bbl., lb	.11¾ -	....
Tallow extra, loose, lb	.08¾ -	....

COAL-TAR PRODUCTS

Alpha-napthol, crude bbl., lb	$0.52 -	$0.55
Alpha-naphthylamine, bbl., lb	.32 -	.34
Aniline oil, drums, extra, lb	.15 -	.16
Aniline, salts, bbl., lb	.22 -	.24
Benzaldehyde, U.S.P., dr., lb	.85 -	.95
Benzidine base, bbl., lb	.70 -	.75
Benzoic acid, U.S.P., kgs., lb	.54 -	.56
Benzyl chloride, tech, dr., lb	.23 -	.25
Benzol, 90%, tanks, works, gal	.15 -	....
Beta-naphthol, tech., drums, lb	.23 -	.24
Cresol, U.S.P., dr., lb	.11 -	....
Cresylic acid, dr., wks., gal	.81 -	.83
Diphenyl, bbl., lb	.15 -	....
Diethylaniline, dr., lb	.40 -	.45
Dinitrophenol	.23 -	.25
Dinitrotoluol bbl., lb	.18 -	.19
Dip oil, 15%, dr., gal	.23 -	.25
Diphenylamine, dr. f.o.b. wks., lb	.60 -	....
H-acid, bbl., lb	.45 -	.50
Hydroquinone, bbl., lb	.90 -	....
Naphthalene, flake, bbl., lb	.07 -	.07¼
Nitrobenzene, dr., lb	.08 -	.09
Paracresol, bbl., lb	.41 -	....
Para-nitraniline, bbl., lb	.47 -	.49
Phenol, U.S.P., drums, lb	.10¼ -	.11
Picric acid, bbl., lb	.35 -	.40
Pyridine, dr., gal	.170 -	1.80
Resorcinol, tech., kegs, lb	.75 -	.80
Salicylic acid, tech., bbl., lb	.33 -	.40
Solvent naphtha, w.w., tanks, gal	.27 -	....
Tolidine, bbl., lb	.86 -	.88
Toluol, drums, works, gal	.33 -	....
Xylol, com., tanks, gal	.26 -	....

MISCELLANEOUS

Casein, tech., bbl., lb	$0.21 -	$0.24
Dry colors		
Carbon gas, black (wks.), lb	.0335 -	.30
Prussian blue, bbl., lb	.36 -	.37
Ultramarine blue, bbl., lb	.11 -	.26
Chrome green, bbl., lb	.21¼ -	.30
Carmine, red, tins, lb	4.60 -	4.75
Para toner, lb	.75 -	.80
Vermilion, English, bbl., lb	2.75 -	2.80
Chrome yellow, C.P., bbl., lb	.14¼ -	.15¼
Gum copal Congo, bags, lb	.09 -	.30
Manila, bags, lb	.09 -	.15
Demar, Batavia, cases, lb	.10 -	.22
Kauri, cases, lb	.18 -	.60
Magnesite, calc, ton	64.00 -	....
Pumice stone, lump, bbl., lb	.05 -	.07
Rosin, H., 100 lb	5.43 -	....
Turpentine, gal	.86½ -	....
Shellac, orange, fine, bags, lb	.39 -	....
Bleached, bonedry, bags, lb	.39	....
T. N. bags, lb	.31 -	....

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Made from *black* rockwool, B-H Mono-block is high-temperature-resistant (up to 1700° F.) and has exceptionally low thermal conductivity. You'll find it lighter, and more efficient, too, because its long, straight fibres are interwoven in layers by an exclusive, patented process. In each block, millions of tiny air-cells hold back the heat, preventing its escape. Because it is a one-block insulation, Mono-block delivers substantial savings in installation costs, too. Send for sample and new bulletin.

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COMPANY

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HEAT & COLD INSULATIONS

NEW CONSTRUCTION

	Current Projects Proposed Work	Current Projects Contracts	Cumulative 1944 Proposed Work	Cumulative 1944 Contracts
New England	....	$360,000	$40,000	$864,000
Middle Atlantic	$80,000	850,000	575,000	1,345,000
South	425,000	7,420,000	905,000	820,000
Middle West	45,000	165,000	125,000	3,717,000
West of Mississippi	4,070,000	....	9,440,000	6,895,000
Far West	40,000	40,000	540,000	4,540,000
Canada	80,000	1,825,000	2,660,000	1,825,000
Total	$4,740,000	$10,660,000	$14,285,000	$20,006,000

PROPOSED WORK

La., Gretna — Gulf Distilling Corp., Gretna, plans the construction of ten 200,000 gal. steel fermenting tanks. L. S. Weil and W. B. Moses, Audubon Bldg., New Orleans, Engrs. Estimated cost $125,000.

Mich., Detroit—Cook Paint & Varnish Co., 3301 Bourke St., is having plans prepared by Harley & Ellington & Clarence E. Day, Archts., 1507 Stroh Bldg., for the construction of an addition to its paint factory. Estimated cost $45,000.

N. J., Elizabeth—Apex Chemical Corp., 200 First St., is having plans prepared by Robert L. Pryor, Archt., 196 Kent Pl. Blvd., Summit, for the construction of a 2 story laboratory. Estimated cost $40,000.

N. J., North Brunswick—E. R. Squibb & Sons, 745 Fifth Ave., New York, N. Y., will soon award the contract for the construction of a 1 story laboratory addition. Abbott & Merkt Co., 10 East 40th St., New York, N. Y., Archts. M. C. Chase, 25 Columbia Heights, Brooklyn, N. Y., Engr.

Ore., Springfield — Willamette Valley Wood Distillation Co., Yeon Bldg., Portland, is having plans prepared by Smith, Hinchman & Grylls, Archts., 800 Marquette Bldg., Detroit, Mich., for the construction of a wood alcohol plant here.

Tenn., Chattanooga—Southern Chemical Cotton Co., M. D. Munson, Pres., plans the construction of a manufacturing plant. Estimated cost $300,000.

Tex., Amarillo—Consumers Cooperative Assn., Amarillo, plans improvements to its refinery. Estimated cost will exceed $40,000.

Tex., Austin—Defense Plant Corp., 811 Vermont Ave., N. W., Wash., D. C., plans to construct additional chemical plant facilities here to be operated by International Minerals & Chemical Corp., Old Georgetown Rd. Estimated cost $175,000.

Tex., Houston—Southern Acid & Sulphur Co., Inc., Rialto Bldg., St. Louis, Mo., plans to construct additional plant facilities here. Project will be financed by Defense Plant Corp., Wash., D. C. Estimated cost $3,500,000.

Tex., Longview—Danciger Oil & Refining Co., W. T. Waggoner Bldg., Fort Worth, plans to construct additional facilities at its refinery here. Estimated cost $80,000.

Tex., Seminole—Phillips Petroleum Co., Philtower Bldg., Tulsa, Okla., plans to construct plant in Seminole Field to have daily capacity of 20,000,000 cu.ft. Estimated cost will exceed $150,000.

Tex., Shamrock—Smith Bros. Refining Co., Shamrock, plans to construct a plant unit for utilizing sweet gas for manufacture of carbon black. Estimated cost will exceed $40,000.

Tex., Velasco—Dow Magnesium Corp., Velasco and Midland, Mich., plans to construct additional facilities at its magnesium plant here. Estimated cost $185,000.

Que., Isle Verte—Premier Peat Moss Corp., 635 Fifth Ave., New York, N. Y., plans the construction of a peat factory and warehouse here.

Que., Lac a la Tortue—Shawinigan Chemicals, Ltd., Shawinigan Falls., Que., plans to reconstruct its plant here.

CONTRACTS AWARDED

Calif., Richmond—General Chemical Co., Russ Bldg., San Francisco, has awarded the contract for the construction of a chemical plant to Bechtel-McCone & Parsons, 601 West 5th St., Los Angeles.

Conn., Naugatuck—Naugatuck Chemical Div. of U. S. Rubber Co., Elm St., has awarded the contract for a 2 story storage building addition and 1 story brine purification plant to W. J. Megin, Inc., 51 Elm St. Estimated cost $75,000.

Conn., West Haven—Armstrong Rubber Co., M. Snyder, 475 Elm St., has awarded the contract for a 3 story, 115x274 ft. factory to Mahoney-Troast Construction Co., 657 Main Ave., Passaic, N. J. Estimated cost $240,000.

Fla., Clewiston—U. S. Sugar Corp., C. R. Bitting, Pres., Clewiston, will construct a starch plant here. Work will be done by own forces. Estimated cost $7,000,000.

O., Cleveland—Industrial Rayon Corp., H. S. Rivitz, Pres., West 98th St. and Walford Rd., has awarded the contract for the construction of a 3 story, 68x82 ft. viscose manufacturing factory to George A. Rutherford Co., 2725 Prospect Ave. Estimated cost $75,000.

O., Columbus—M & R Dietetic Laboratory, Inc., 585 Cleveland St., has awarded the contract for a 4 story, 42x64 ft. factory addition and 1 story power plant, boilers, etc., to E. E. Elford & Son, 555 South Front St. Estimated cost $50,000.

Pa., DuBois—B. F. Goodrich Co., 500 South Main St., Akron, O., has awarded the contract for altering 2 story, 100x120 ft. manufacturing plant to W. S. Johnson Bldg. Co., 2532 Hyde Park Bldg., Niagara Falls, N. Y. Estimated cost $50,000.

Pa., Glassmere—Aluminum Co. of America, R. O. Keefer, Purch. Agt., 801 Gulf Bldg., Pittsburgh, has awarded the contract for the construction of an atomized aluminum plant for Navy Dept., to Day & Zimmerman, Inc., Packard Bldg., Philadelphia. Estimated cost $800,000.

R. I., Woonsocket—Goodyear Fabric Corp., Orchard St., New Bedford, Mass., has awarded the contract for alterations and addition to its plant to Gilbane Building Co., Inc., 90 Calverly St., Providence. Estimated cost $45,000.

W. Va., New Martinsville—Columbia Chemical Div., Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh, Pa., has awarded the contract for chemical plant expansion, including new processing equipment, to H. K. Ferguson Co., 1422 Euclid Ave., Cleveland, O. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost $420,000.

Wis., Wausau—Defense Plant Corp., 811 Vermont Ave., N. W., Washington, D. C., will construct a 1 story, 100x192 ft. addition to factory here to be operated by Marathon Battery Co., 840 Henrietta Ave. Work will be done by day labor.

Ont., Port Clairborne—Canada Cement Co., Ltd., Canada Cement Bldg., Montreal, Que., will construct six cement storage silos and office building. Work will be done by owner's forces. Estimated cost $325,000.

Ont., Peninsula—Marathan Paper Mills of Canada, Ltd., 320 Bay St., Toronto, Ont., has awarded the contract for the construction of a pulp and paper mill to Foundation Co. of Canada, Ltd., 115 Bay St., Toronto. Estimated cost $1,500,000.